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U.S. Environmental Protection Agency, July 20, 2008, *Final Removal Action Report for Black Butte Mine, Cottage Grove, Oregon*, 140 pages.

REFERENCE 5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10 Emergency Response Unit
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Seattle, Washington 98101-3140

Final Removal Action Report for Black Butte Mine
Cottage Grove, Oregon

July 20, 2008

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United States Environmental Protection Agency

REMOVAL ACTION REPORT
BLACK BUTTE MINE SITE
COTTAGE GROVE, OREGON

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BLACK BUTTE MINE SITE
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Acronym	Definition
AINW	Archaeological Investigations Northwest
BBM	Black Butte Mine
bgs	below ground surface
CERCLA	Comprehensive Environmental Response,Compensation,and Liability Act
E & E	Ecology and Environment, Inc.
EQM	Environmental Quality Management, Inc.
EPA	United States Environmental Protection Agency
ERRS	Emergency and Rapid Response Services
H&S	health and safety
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
NCP	National Contingency Plan
ODEQ	Oregon Department of Environmental Quality
OSC	On-Scene Coordinator
POLREP	pollution report
PRG	preliminary remediation goal
PRP	potentially responsible party
PST	Pacific Strike Team
SLV	Screening Level Values
SSSP	Site-Specific Sampling Plan
SHPO	State Historical Preservation Office
START	Superfund Technical Assessment and Response Team
SPLP	Synthetic Precipitate Leaching Procedure
TCLP	Toxicity Characteristic Leaching Procedure
TDD	Technical Direction Document
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
XRF	X-ray Fluorescence

EXECUTIVE SUMMARY

The United States Environmental Protection Agency (EPA) has completed a Removal Action at the Black Butte Mine site near Cottage Grove, Oregon in Lane County. The site is the location of a former mercury mine and previous environmental investigations indicated widespread mercury contamination in site surface soils and mine waste-rock and tailings.

The site is currently owned by the Land and Timber Company who purchased it in 1994. Site investigations have been performed by the Oregon Department of Environmental Quality, Oregon State University and others since the early 1990s. The EPA completed a removal assessment at the site in 2006 and recommended a removal action (E & E 2006).

The Removal Action was performed between August 20 to September 3, 2007. During the Removal Action, the EPA and its contractors regraded the steep slopes of the site's Main Tailings Pile along one of the three creeks at the site to prevent tailings material to continue washing into the creek. The action level for water quality in the impacted creeks was defined as three times the background concentration.

A substantial amount of tailings were removed during the regrading and used as capping material for two other highly contaminated areas on the site. The material used for capping contained mercury at concentrations less than the action level established for dermal contact, and was confirmed by on-site sampling and analysis.

During the Removal Action, additional analytical assessment was performed on Furnace Creek sediments and banks. The results indicated there was much more extensive contamination than anticipated. In addition, the creek was highly vegetated and any clearing and excavation of these materials had a potential for environmental damage. Excavation of all the contaminated materials within and along Furnace Creek was beyond the budgeted ceiling and duration for the planned Removal Action so clean up of that area was referred to the EPA Remedial Program.

The final report is organized into the following sections: Summary of Events (Section I), Effectiveness of Removal Action (Section II), Difficulties Encountered (Section III), Recommendations (Section IV), and References (Section V). Selected photographs of site activities are included in Appendix A.

I. SUMMARY OF EVENTS

A. SITE CONDITIONS AND BACKGROUND

This section includes a description of the site location, site layout, a brief summary of the history of operations at the site, and previous investigations.

1. Initial Situation

The Black Butte Mine (BBM) is a former mercury mine located in southern Lane County, in the Coast Fork Willamette River Basin; approximately ten miles south of Cottage Grove, Oregon (see Figure 1-1). The BBM is located on the northwest flank of Black Butte at latitude 43 degrees 34 minutes 42 seconds north, longitude 123 degrees 3 minutes 58 seconds west in Section 6, Township 23 South, Range 3 West of the Willamette Baseline and Meridian. The site is bordered to the northeast by Dennis Creek, to the southwest by Furnace Creek, to the southeast by Black Butte mountain, and to the northwest by Garoutte Creek and the Pooler residence. Both Dennis Creek and Furnace Creek flow west–northwest to Garoutte Creek which flows northward approximately six miles to the Coast Fork of the Willamette River. The Coast Fork of the Willamette River empties into Cottage Grove Reservoir. Motor vehicle access to the site is restricted by locked gates. The road leading to one of the gates crosses private property owned by Michael Pooler. Mr. Pooler is a former BBM worker and currently lives at the entrance to the site.

The site layout is presented as Figure 1-2. The primary features of the site include a former mill structure containing a rotary kiln, mercury condenser, and ore storage/crushing equipment (New Furnace Area), another mill and furnace area (Old Ore Furnace), several old dilapidated buildings, waste rock / tailings piles, a system of unimproved roads, and mine adits. The main tailings pile, containing both waste rock and mill tailings, is located in a relatively flat area below the New Furnace Area. It is bordered on the northeast by Dennis Creek. Remnants of a second waste pile lie to the northwest of the Old Ore Furnace. This area borders Furnace Creek to the southwest.

The BBM was first operated in the late 1890s. The mine operated intermittently through the late 1960s, with peak production occurring during the period from 1927 to 1943. Between the years 1900 and 1957, a total of 16,904 flasks of elemental mercury were produced at the mine (one flask equals 76 pounds). The current owner, Land and Timber Company, has used the property for logging.

There have been no previous removal actions at the BBM Site. However, there have been a number of previous sampling events. Prior sampling or assessment events include:

- Oregon State University (OSU), Department of Fisheries and Wildlife (OSU 1990);
- U.S. Fish and Wildlife Service (USFWS 1992);
- U.S. Geological Survey (USGS 1993);
- OSU Department of Fisheries and Wildlife (OSU 1992, 1994);
- Oregon Department of Environmental Quality (ODEQ) Preliminary Assessment (ODEQ 1996);
- E & E for U.S. Environmental Protection Agency (EPA) Region 10 Site Inspection (E & E 1999)
- OSU for U.S. Army Corps of Engineers, Portland, Oregon, Sources and Chronology of Mercury Contamination in Cottage Grove Reservoir (OSU 2003);
- OSU for ODEQ, Reconnaissance Soil Sampling at the BBM (ODEQ 2004).

These investigations are described in the "Black Butte Mine removal assessment Report" (E & E 2006).

In July 2004, ODEQ asked EPA to conduct a removal assessment . The removal assessment focused on the five main areas of contamination identified through previous investigations (Figure 1-2):

- Main Tailings Pile;
- Old Ore Furnace Area;
- New Furnace Area;
- Other areas of potential contamination (including adits and associated waste rock, seeps); and
- Sediment and water in Furnace Creek, Dennis Creek, and Garoutte Creek.

Field work for the removal assessment was performed in September 2005, and the final report with Removal Action recommendations was delivered to EPA in March 2006. Each of the five main areas of contamination were assessed based on the results of sampling and analysis for the removal assessment (E & E 2006) and on the results of the 1998 EPA site inspection (E & E 1999). Analytical methods utilized in site characterization included analyses for total mercury and arsenic, toxicity characteristic leaching procedure (TCLP), synthetic precipitate leaching procedure (SPLP), and selective sequential extraction of mercury. Removal Action

recommendations were made for the Main Tailings Pile, Old Ore Furnace Area, New Furnace Area, and Furnace Creek.

2. Action Levels

The contaminant of concern, mercury, is a hazardous substance and pollutant or contaminant as defined by sections 101(14) and 101(33) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 U.S.C. § 9601(14) and (33).

The EPA Region 9 Preliminary Remediation Goal (PRG) for mercury in soil in a residential setting is 23 milligrams per kilogram (mg/kg)[1]. This value is based on the toxicity of mercuric chloride for dermal contact. Where the removal assessment's selective sequential extraction results indicated mercury was present in a soluble form, and the conceptual site model indicated the transport mechanism was strictly dermal contact, the clean up level was set at 23 mg/kg (Parker 2007). This action level was applied at the Old Ore Furnace area.

For areas of the site where selective sequential extraction results indicated that mercury was in tightly bound form, ODEQ recalculated the PRG based on mercuric sulfide rather than the more soluble mercuric chloride and determined that 115 mg/kg would be an equivalent action level. The action level for areas where dermal contact was a concern, and selective sequential extraction results indicated that mercury was in tightly bound form, was set at 115 mg/kg. This action level was applied at the New Furnace area, the regraded slopes of the Main Tailings Pile, and the material taken from the Main Tailings Pile to be used as clean cover.

In areas with potential for flooding or erosion into a creek and water quality was the primary concern, the action level was set at 10 mg/kg. This value was calculated by first determining the average background mercury concentration in the area (outside of the local area of soil formed from mercury bearing ore) and then multiplying this value by three. This action level was applied to the the Main Tailings Pile where material could move into Dennis Creek, to the Old Ore Furnace area where material could move into Furnace Creek, and to Furnace creek itself.

3. Location of Hazardous Substances

The following sections summarize the results and recommendations from the removal assessrnent for BBM as well as additional characterization and confirmation sampling conducted during the Removal Action.

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[1] Note EPA Region 9 PRGs were used at the time of the Removal Assessment. The EPA Region 6 Human Health Medium Specific Screening Levels now in current use instead of the PRGs.

a) Main Tailings Pile

Total mercury in waste rock / tailings samples collected from the Main Tailings Pile during the removal assessment ranged from 0.14 to 2,420 milligrams per kilogram (mg/kg). The maximum concentration of mercury was found in a sample from a depth of 16 to 20 feet below ground surface (bgs) and was located in the approximate middle of the Main Tailings Pile. This distribution of mercury was determined in the removal assessment to result from heterogeneity of tailings in terms of mineral and chemical composition, as well as a wide grain-size distribution. This heterogeneity is believed to be due to changes in ore processing equipment and techniques, the nature of the ore extracted over the period of mine operations, and the depositional history of mine waste rock / tailings. Leaching of mercury from tailings as precipitation migrates through the tailings was also considered to be a potential factor in this distribution. However, results of SPLP analysis for mercury in tailings samples from the Main Tailings Pile indicated that leaching is either not occurring or is occurring at a very low level. Sequential selective extraction of mercury also indicated that the mercury present in this area is not highly soluble. Based on these results, it was determined that the main mechanism for mercury within the tailings to migrate to adjacent creeks was through mechanical means such as erosion.

The waste rock / tailings along the northeast side of the Main Tailings Pile followed a steep angle down toward Dennis Creek. The waste rock / tailings along this side of the pile was unstable and subject to erosion and undercutting by unnamed drainages that were tributaries to Dennis Creek. Stabilization of waste rock / tailings in this area of the Main Tailings Pile was recommended to reduce the likelihood the material would continue to erode into Dennis Creek.

Additional sampling and analyses of the material from the Main Tailings Pile was completed during the Removal Action using a field portable x-ray fluorescence instrument (XRF). Results of the sampling and analyses are presented in Figures 2A, 2K, 2L, and 2N and are also summarized in Table I-1. Samples 10EK-1001 through 10EK-1028 were collected prior to excavation and re-grading of the slope to determine if mercury concentrations in these materials were low enough to be used as "clean cover" in other parts of the BBM Site. Total mercury concentrations in tailings samples, analyzed using an XRF, ranged from non-detect (or less than 9.7 mg/kg) to 340 mg/kg. Five of the 28 samples collected were above 115 mg/kg. Only material with a mercury concentration less than 115 mg/kg was used for capping other areas of the site. Material with mercury concentrations higher than 115 mg/kg were placed in the repository.

Samples 10EK-1031 through 10EK-1050 were collected from the eastern end of the Main Tailings Pile along Dennis Creek (see Figure 2A) after slope re-grading was completed to confirm that total mercury in exposed tailings was below the 115 mg/kg action level. Total mercury concentrations ranged from 18.5 mg/kg to 61.1 mg/kg. Samples 10EK-1051 through 10EK-1074 were collected from the western end of the Main Tailings Pile along Dennis Creek (see Figure 1L) after slope re-grading was completed to confirm that total mercury in exposed tailings was below the 115 mg/kg action level. Total mercury concentrations ranged from non-detect (or less than 10.8 mg/kg) to 36.4 mg/kg.

b) Old Ore Furnace Area

A thin layer of waste rock / tailings covered the majority of the area immediately adjacent to the Old Ore Furnace. Historically, tailings were reportedly removed from this area and reprocessed through the New Furnace after it became operational. Further downslope from the Old Ore Furnace, tailings were thicker and may not have been reprocessed. These tailings appeared to have spilled into Furnace Creek. Total mercury concentrations in tailings samples from the Old Ore Furnace Area, collected during the removal assessment, ranged from 16.1 mg/kg to 1,180 mg/kg. The highest concentration of total mercury (1,180 mg/kg) was detected in a tailings sample from 0 to 4 feet depth and located downslope of the Old Ore Furnace. Results of SPLP analysis for mercury in samples from the Old Ore Furnace area indicate that leaching is either not occurring or is occurring at a very low level. Sequential selective extraction mercury analyses of samples from this area suggested that the majority of mercury present in this area could be characterized as insoluble and but some of it was in a readily methylated form. Based on these results, it was determined that the primary mechanism for mercury transport was by mechanical processes such as erosion, however the lower action level of 23 mg/kg was used to address the more methylated forms of mercury present.

Additional sampling and analyses of the tailings and soil near the Old Ore Furnace Area was completed during the Removal Action using an XRF and a a Lumex Mercury Analyzer with a soil attachment (Lumex). Results of the sampling and analyses are presented in Figures 2C through 2G and are also summarized in Table I-2. Samples 10EK-3001 through 10EK-3018 and 10EK-3019 through 10EK-3087 were collected to further delineate the extent of contamination in the area immediately adjacent to the Old Ore Furnace and upslope of the Old Ore Furnace, respectively. Further delineation was conducted to insure that any removal action conducted in this area would be complete. The action level for dermal exposure to mercury in this area was 23 mg/kg. Total mercury concentrations ranged from non-detect (or less than 12.4 mg/kg) to 10,500 mg/kg (Table I-2). Seventy-five of a total of 80 samples collected

immediately adjacent as well as upslope of the Old Ore Furnace were above the action level of 23 mg/kg.

Samples 10EK-3089 through 10EK-3109 were collected from the areas immediately adjacent and upslope of the Old Ore Furnace, after the area was capped, to confirm that total mercury was below the 115 mg/kg action level for the capping material. Total mercury concentrations by XRF in these 21 confirmation samples ranged from non-detect (or less than 12.5 mg/kg) to 22.9 mg/kg.

c) New Furnace Area

During the removal assessment, the New Furnace Area was inaccessible to the Geoprobe so borings were not collected in this area. Instead, data from the Site Inspection were used in characterization. Total mercury concentrations in samples collected around the New Furnace ranged from 91.9 to 54,300 mg/kg. The highest concentrations of mercury were in the immediate area of the mill structure and furnace, possibly due to spillage of elemental mercury during processing activities.

Downslope from the New Furnace Area, total mercury concentrations in waste rock / tailings samples were less than 23 mg/kg. The low concentrations of mercury in these samples may be attributable to higher efficiency of the "New Furnace". Mercury was detected in the SPLP leachate, at a low concentration of 0.00149 mg/L, from a tailings sample collected downslope from the New Furnace Area. In addition, sequential selective extraction analysis for mercury suggested that the mercury present in the waste rock / tailings in this area was not highly soluble or readily methylated.

To identify the edge of the area to be capped, additional sampling and analyses of the tailings and soil around the New Furnace Area were completed during the Removal Action using an XRF. Results of the sampling and analyses are presented in Figure 2B and are also summarized in Table I-3. Samples 10EK-2001 through 10EK-2023 were collected for this purpose and total mercury concentrations as analyzed using an XRF ranged from 32.6 mg/kg to 1,630 mg/kg (Table I-3).

Samples 10EK-2024 through 10EK-2046 were collected from the cap on the New Furnace Area to confirm that total mercury at the surface was below the 115 mg/kg action level. Total mercury concentrations in cap confirmation samples ranged from non-detect (or less than 11.4 mg/kg) to 94.1 mg/kg.

d) Furnace Creek, Dennis Creek, Garoutte Creek

Sampling of sediment and water from Furnace Creek, Dennis Creek, and Garoutte Creek was completed as part of the removal assessment. All of the sediment samples collected for the removal assessment, including the background samples, exceeded ecological screening criteria for mercury. Background concentrations were also higher than the selected criteria. Elevated background concentrations are natural and can be expected in a mineralized area such as the area surrounding BBM. Interpretation and recommendations were thus based on how mercury concentrations in downstream sediments compared to background sediment concentrations. Additional sampling and analyses of the tailings and sediment in Furnace Creek, Dennis Creek, and Garoutte Creek were completed during the Removal Action using both an XRF and a Lumex. Results of both sets of sampling and analyses are summarized for each creek in the following subsections.

(1) Furnace Creek

Total mercury in only one of the sediment samples collected during the removal assessment substantially exceeded three times the background concentration of 1.7 mg/kg[2]. This sample was collected from Furnace Creek in the area where tailings downslope from the Old Furnace are in contact with the creek. This sample also was analyzed for monomethylmercury. The resulting monomethylmercury concentration of 0.0127 mg/kg exceeded the ODEQ Level II soil Screening Level Values (SLV) for plants.

Additional sampling and analyses of the tailings and sediment in Furnace Creek was completed during the Removal Action using both an XRF and a Lumex instrument. Sample locations extended upslope from the Old Furnace Area to Garoutte Creek. Results of the sampling and analyses of sediment and bank samples from Furnace Creek are presented in Figures 2C through 2J and are also summarized in Table I-4. Sediment and tailing samples 10EK-4001 through 10EK-4072 were collected from Furnace Creek itself. Total mercury concentrations in these samples ranged from 1.62 mg/kg to 486 mg/kg. Sediment and tailing samples 10EK-4001 through 10EK-4022, which are adjacent or upslope of the Old Furnace appear to represent background concentrations with the exception of 10EK-4010 (5.39 mg/kg). Total mercury concentrations ranged from 1.62 mg/kg to 5.39 mg/kg. Sediment and tailings samples 10EK-4023 through 10EK-4072 are located adjacent to the Old Furnace and extend down to Garoutte Creek. All samples had total mercury concentrations above background.

[2] Note for Furnace Creek, three times the background concentration of 1.7 mg/kg is 5.1 mg/kg.

Total mercury concentrations for samples 10EK-4023 through 10EK-4072 ranges from 21.1 mg/kg to 486 mg/kg.

Soil and tailings samples 10EK-4101 through 10EK-4173 were collected from the northeast bank of Furnace Creek approximately five feet up from the creek itself. Total mercury concentrations from samples 10EK-4101 through 10EK-4122 appeared to represent background concentrations. Total mercury concentrations in these samples ranged from non-detect (or less than 0.08 mg/kg) to 3.99 mg/kg, with the exception of a single sample that had a concentration of 16.0 mg/kg. Total mercury concentrations in samples 10EK-4123 through 10EK-4173 were quite variable and ranged from non-detect (less than 0.08 mg/kg) to 9,160 mg/kg. These sample locations are adjacent to the Old Furnace and extend down to Garoutte Creek. Forty-four of the fifty-one samples collected from adjacent to or downslope of the Old Furnace exceeded three times the background concentration determined for Furnace Creek sediment.

Soil and tailings samples 10EK-4201 through 10EK-4273 were collected from the northeast bank of Furnace Creek approximately ten feet up from the creek itself. Total mercury concentrations from samples 10EK-4201 through 10EK-4223 appeared to represent background concentrations. Total mercury concentrations in these samples ranged from non-detect (less than 0.47 mg/kg) to 2.04 mg/kg. Total mercury concentrations in samples 10EK-4224 through 10EK-4273 were variable and ranged from non-detect to 358 mg/kg. These sample locations are adjacent to the Old Furnace and extend downstream to Garoutte Creek. Thirty-eight of the fifty samples collected from adjacent to or downslope from the Old Furnace exceeded three times the background concentration determined for Furnace Creek sediment.

Soil and tailings samples 10EK-6101 through 10EK-6273 were collected from the southwest bank of Furnace Creek, approximately five feet up from the creek bed. Total mercury concentrations ranged from non-detect (less than 0.60 mg/kg) to 267 mg/kg. Fifty-nine of the seventy-eight samples collected from the southwest bank exceeded three times the background concentration determined for Furnace Creek sediment.

(2) Dennis Creek

The background concentration for mercury in Dennis Creek sediments was determined to be 7 mg/kg, based on sampling completed in the removal assessment. Total mercury concentrations from sediment samples collected during the removal assessment ranged from 0.54 mg/kg to 7 mg/kg. The sample containing 7 mg/kg was taken from approximately 200 feet upgradient of the confluence of Dennis Creek with the drainage from the Dennis Creek Adit

area. The background concentration therefore may reflect the influence of mining activities further upslope of Dennis Creek Adit and 404 Adit[3] or aerial deposition of mercury from inefficient recovery during early processing operations (OSU 2004).

Sediment samples 10EK-8001 through 10EK-8041 were collected from within Dennis Creek. Sample locations extended upslope from the Main Tailings Pile and New Furnace Area to the confluence of Dennis Creek with Garoutte Creek. Results of the sampling and analyses of sediment from Dennis Creek are presented in Figures 2A, 2L, 2M, and 2N and are also summarized in Table I-5. Total mercury concentrations ranged from non-detect (less than 0.46 mg/kg) to 17.9 mg/kg. None of the forty-one samples collected from Dennis Creek sediments exceeded three times the Dennis Creek background concentration.[4]

(3) Garoutte Creek

The background concentration for mercury in Garoutte Creek sediments was determined to be 0.45 mg/kg, based on sampling from the removal assessment. Total mercury concentrations from sediment samples collected during the removal assessment ranged from 0.45 mg/kg to 1.2 mg/kg.

Sediment samples 10EK-9001 through 10EK-9009 were collected from within Garoutte Creek during the Removal Action. Sample locations extended upslope from the Main Tailings Pile and New Furnace Area to the confluence of Dennis Creek with Garoutte Creek. Results of the sampling and analyses of sediment from Garoutte Creek are presented in Figure 2N and are also summarized in Table I-6. Total mercury concentrations ranged from non-detect (less than 0.17 mg/kg) to 2.02 mg/kg. One of the nine samples collected from Garoutte Creek sediments exceeded three times the Garoutte Creek background concentration[5].

4. Cause of Release or Discharge

Mercury occurs naturally at the BBM Site in mercury-bearing ore. The distribution of mercury throughout the BBM Site, however is primarily the result of the mining operations that occurred from the late 1890s through the late 1960s.

The primary ore mineral at the site was cinnabar, a mercuric sulfide. Minor amounts of metacinnabar (another form of mercuric sulfide) and elemental mercury were also naturally present in the ore (Brooks 1971). The extraction and processing of the mercury-bearing ore (including roasting of crushed ore) alters the mercury-bearing ore both physically and

[3] Dennis Creek Adit and 404 Adit are adits associated with mining activities at Black Butte Mine that were investigated in the Removal Assessment (E & E 2006).
[4] Note for Dennis Creek, three times the background concentration of 7 mg/kg is 21 mg/kg.
[5] Note for Garoutte Creek, three times the background concentration of 0.45 mg/kg is 1.35 mg/kg.

chemically. Physically, the materials left after processing (waste rock and particularly tailings) are more vulnerable to mechanical movement through natural processes due to the smaller grain-size and are in unstable settings, such as in huge piles with steep slopes adjacent to rivers and creeks. Chemically, some of the mercury sulfide in the mercury-bearing ore is converted into other forms of mercury that are more reactive and more soluble and therefore more mobile in the environment.

During the removal assessment, analyses were completed to determine the species and solubility of mercury present on site. Based on the low concentrations of total mercury in leachates produced using SPLP and on the low solubility of the predominant mercury species indicated by sequential selective extraction, the main mechanism for the transportation of mercury in the environment at BBM was determined to be mechanical (i.e. erosion).

5. Efforts to Obtain Response by Responsible Parties

The property was purchased by the Land and Timber Company in January 1994. The Land and Timber Company still owned the property and was in the processes of logging part of it at the time of the Removal Action. (Parker 2007)

In 2002 ODEQ designated the BBM as an "Orphan Site" and made the site account available for funding of stabilization and cleanup of the mine because the land owner, The Land and Timber Company, was unwilling to complete the investigation/cleanup of the BBM site (Spencer 2002). ODEQ subsequently requested that EPA carry out a removal action at the site.

EPA contacted the lawyer for the company, Robert Smejkel, in 2006 and in 2007 requesting that the company perform the cleanup but was told that the company lacked the funds to do so.

B. ORGANIZATION OF THE RESPONSE

EPA was the lead agency in charge of the Removal Action. Throughout the Removal Action, EPA worked closely with ODEQ. EPA On-Scene Coordinator (OSC) Kathy Parker was on site throughout the Removal Action to oversee the cleanup activities.

The cleanup work was performed by Environmental Quality Management, Inc. (EQM), as the Environmental and Rapid Response Services (ERRS) contractor to EPA Region 10.

Members of the United States Coast Guard (USCG) Pacific Strike Team (PST) were on site during the RA to oversee site health and safety (H&S) and to perform air monitoring.

Ecology and Environment, Inc. (E & E), the Superfund Technical Assessment and Response Team (START)-3 contractor, provided engineering designs, analytical support, and documentation support for the Removal Action.

C. INJURY / POSSIBLE INJURY TO NATURAL RESOURCES

Based on the pre-Removal Action conditions at the site, EPA determined that the site was a threat to the public health or welfare or the environment and that a removal action was appropriate under Section 300.415(b)(2) of the National Contingency Plan (NCP) (Parker 2007).

The elevated concentrations of mercury in waste rock and tailings of the Main Tailings Pile, Old Furnace Area, New Furnace Area, and Furnace Creek, and the proximity of the site to Dennis, Furnace, and Garoutte Creeks, indicated the presence of human exposure pathways. A previous report concluded that the BBM is the source of elevated levels of mercury in Cottage Grove Reservoir fish (Park and Curtis 1997).

The mine waste-contaminated soils were not vegetated, thus the soils were susceptible to migration due to water- and wind-borne influences. Erosion throughout the contaminated materials was widespread and moved material into the active waterways of Dennis, Furnace, and Garoutte Creeks and elsewhere throughout the site.

Mine wastes were slumping and eroding directly into the creeks with subsequent transport downstream. During the springtime, snow melt, rainfall or other run-off inducing events tended to spread the contaminated materials further from the site. The warmer temperatures and dry weather typical in the summer and fall months in and near the site contributed to wind-borne dispersal of mine contaminants.

Ecological receptors had been exposed to site contaminants through direct contact with mine-waste contaminated materials and with water and sediments contaminated by mine-waste materials; ingestion of mine-waste materials and water and sediments contaminated by mine-waste materials; and/or ingestion of contaminated food (e.g., sediment- or soil-dwelling insects, vegetation). Highly contaminated sediment from the mine site was believed to be transported downstream.

The concentration of mercury in Furnace Creek was likely the result of mine-waste materials migrating off the site. Excavation of the mine waste-contaminated materials was expected to have a positive effect on surface water quality and the sensitive aquatic ecosystem of Furnace Creek.

There was cause for concern near the BBM Site and for some distance downstream in Dennis, Furnace, and Garoutte Creeks because of the likelihood for continued erosion of

contaminated materials into the stream and subsequent downstream material migration. Recover and restoration efforts for fish and other species should be enhanced with improved water quality in Cottage Grove Reservoir and the Willamette River drainage. (Parker 2007)

1. Content and Time of Notice to Natural Resource Trustees

In June 2006, Preston Sleeger of the U.S. Department of Interior was notified of the proposed removal action activities and provided background information on the site. There were no tribes on the BBM drainage area but the proposed removal work was shared at that time with the Confederated Tribes of the Coos, the Lower Umpqua and Siuslaw, the Cow Creek, The Cow Creek Band of Umpqua, and the Confederated Tribes of the Siletz.

2. Trustee Damage Assessment and Restoration Activities

No assessment or restoration acitivites are known to have been attempted but any trustees.

D. CHRONOLOGICAL NARRATIVE OF RESPONSE ACTIONS

1. Threat Abatement Actions Taken

This response was conducted under the authority of CERCLA Section 1049(a). To mitigate the potential hazards to human health and the environment from mercury contaminated waste rock and tailings, EPA performed a cleanup action which included the stabilization of slopes and the construction of protective covers over contaminated areas.

The following summarizes the chronology of BBM Removal Activities:

- **July 2004:** ODEQ requested that EPA conduct a removal assessment at the Black Butte Mine site.
- **September 2005:** START conducted field activities for the removal assessment including specialized analyses for mercury. The removal assessment report was completed in March 2006 (E & E 2006).
- **September 2006**: A topographic survey was conducted of areas to be addressed in the removal action.
- **December 2006:** A cultural resources survey was conducted of areas to be addressed in the removal action.
- **February-March 2007:** START submitted a conceptual design for the removal action to EPA.

- **August 20 to September 3, 2007,** the Removal Action (RA) and further assessment was performed at the site:
- **August 20, 2007:** EPA, USCG, ODEQ and ERRS personnel and equipment mobilized to the Black Butte Mine Site. On-site activities for the RA began with site orientation meetings. Resident Michael Pooler located and marked his above-ground household water holding tank and line which ran through the Old Furnace area. ERRS cleared, grubbed, widened and graded the access roads to the site and repository area. ODEQ, USCG and EPA analyzed soils and mine tailings in the Old Furnace Area, New Furnace Area, and the repository area for mercury by XRF.
- **August 21, 2007:** Soils upslope from the Old Ore Furnace were analyzed for mercury by XRF. ERRS started grading and laying back the east slope of the Main Tailings Pile and filled the water truck at an approved location on Cottage Grove Lake. ERRS cleared, grubbed, widened and graded the access roads to the Main Tailings piles and the New Furnace Area.
- **August 22, 2007:** START arrived on site to provide on-site field laboratory analyses for mercury and collected tailings samples from the east Main Tailings Pile for mercury analysis. ERRS continued excavating the west Main Tailings pile and started hauling tailings, which had been verified to have less than 115 mg/kg mercury concentration, from the Main Tailings pile to the New Furnace area for capping and compacting them.
- **August 23, 2007:** ODEQ, START and USCG started collecting samples from Furnace Creek for mercury analysis by XRF and Lumex. ERRS continued regrading the Main Tailings piles and hauling "clean" tailings to the New Furnace area and the repository.
- **August 24, 2007:** Tailings samples were collected from the west Main Tailings Pile for mercury analysis. START determined the Lumex can not accurately analyze tailings due to the mercury being too tightly bound chemically. Only XRF will be used for tailings analysis. ERRS continued regrading the Main Tailings piles and hauling "clean" tailings to the New Furnace area and the repository.
- **August 25, 2007:** ERRS started clearing, grubbing and filling in holes and a large tank on the Old Furnace Area and continued regrading the Main Tailings piles and contouring drainage benches. Tailings samples were collected from the

west Main Tailings Pile for mercury analysis. START began mercury method detection limit analyses on the XRF and Lumex.

- **August 26, 2007:** No site work performed.
- **August 27, 2007:** ERRS continued clearing, grubbing and filling the Old Furnace Area and started hauling capping material from the Main Tailings piles to the Old Furnace Area. ERRS continued regrading the Main Tailings piles and contouring drainage benches. START and USCG continued collecting samples from Furnace Creek for mercury analysis by XRF and Lumex. Soil and tailings samples were collected for mercury analysis from the New Furnace Area.
- **August 28, 2007:** ERRS continued regrading the Main Tailings piles and contouring drainage benches and hauling capping material from the Main Tailings piles to the Old Furnace Area. ERRS made a road from the main site road to a large tailings pile overlooking Furnace creek then dug a test pit to determine the depth of the tailings on the banks of Furnace creek. START and USCG continued collecting samples from Furnace Creek for mercury analysis by XRF and Lumex.
- **August 29, 2007:** ERRS continued regrading the Main Tailings piles and contouring drainage benches and hauling capping material from the Main Tailings piles to the Old Furnace Area. USCG continued analyzing samples from Furnace Creek for mercury analysis by XRF. One USCG personnel demobilized.
- **August 30, 2007:** ERRS continued hauling capping material from the Main Tailings piles to the Old Furnace Area. Final confirmation samples were collected from the east Main Tailings Pile for mercury analysis. Mercury analyses were performed on soil and tailings around the Old Furnace to delineate the area for capping. Analyzed soil from borrow slope to determine if mercury concentrations are low enough to use as clean topsoil cover in capped areas. TV and newspaper reporters (KEZI, KVAL, Cottage Grove Sentinel) on site for interviews with EPA, ODEQ and Oregon State Governor's office.
- **August 31, 2007:** West Main Tailings Slope re-grading was completed. Final mercury confirmation analyses were performed on tailings on the surface of the re-graded slope of the west Main Tailings Pile. Completed hauling capping material from the Main Tailings piles to the Old Furnace Area and finsihed clearing and capping Old Furnace Area. ERRS started hauling clean topsoil from the borrow slope to the eaat Main Tailings pile. ERRS started placing straw bales

on the Main Tailings piles for erosion control. A new gate was installed at the entrance to the site. Sediment samples were collected from Dennis Creek and Garoutte Creek for mercury analysis using the Lumex. Three ERRS and one START personnel demobilized

- **September 1, 2007:** Grading and compacting of slopes and benches on the west Main Tailings pile was completed and straw bales and water bars were installed. Continued to spread topsoil on both east and west slopes. XRF analyses performed on dried sediments from Dennis Creek.
- **September 3, 2007:** Mercury analyses of samples from Dennis Creek, Furnace Creek, and Garoutte Creek and final confirmation analyses of the Old Furnace cap were completed. ERRS Continued to spread topsoil on both east and west slopes. START personnel and equipment demobilized from the site.
- **September 4, 2007:** ERRS cleaned up the borrow slope area and placed slash on it and on the road to the New Furnace cap. USCG personnel and equipment demobilized from the site.
- **September 5, 2007:** ODEQ arrived on site, picked up ODEQ equipment and walked the site with the OSC for a debriefing on the RA. ERRS and EPA personnel and equipment demobilized from the site.

2. Treatment / Disposal / Alternative Technology Approaches Pursued

The selected removal activities performed by EPA involved both regrading and capping with tailings that contained mercury concentrations lower than the cleanup level. The removal activities did not involve treatment or disposal. No specific alternative technologies were required to cost effectively achieve the objectives of the removal assessment.

As described above, ODEQ established a site-specific cleanup level for mercury in soil which was derived from the EPA Region 9 PRG for mercury in soil in a residential setting. ODEQ calculated the site-specific cleanup level based on the reduced toxicity of mercuric sulfide in comparison to mercuric chloride, which was used for the EPA Region 9 PRG. Therefore, the site specific action level, for areas where dermal contact was a concern, was 115 mg/kg.

In addition, because mercury concentrations were naturally elevated in area creeks, concentrations of three times background were calculated for Furnace Creek, Dennis Creek, and Garoutte Creek sediments in the removal assessment (E & E 2006). Based on these

calculated values and the available analytical capability, 10 mg/kg was chosen as the action level for the creeks and areas where sediment could move into the creeks.

3. Public Information and Community Relations Activities

Throughout the removal activities, EPA provided the public with ongoing information regarding the site and the progress of the cleanup actions. EPA prepared and distributed a fact sheet for the Removal Action.

The OSC issued periodic pollution reports (POLREPs) and maintained a website with information about the site and the ongoing cleanup: www.epaosc.org/BlackButteMine. Examples of the public notifications, including a screenshot of the website, the POLREPS, the Fact Sheet, and a newspaper clipping, are presented in Appendix B.

E. RESOURCES COMMITTED

EPA costs for the Black Butte Mine RA included direct EPA costs (intramural) and contractors (extramural). Estimated costs for the RA as of May 31, 2008, are summarized below:

	Cost to Date
Intramural Costs	
EPA Direct Costs	$43,980
EPA Indirect Costs	$81,649
Extramural Costs	
ERRS	$214,800
USCG	$7,500
START	$124,219
Estimated Total Project Costs	$472,148

Figure 1

SITE LOCATION MAP

BLACK BUTTE MINE
Lane County, Oregon

SOURCE: DeLorme, 1991, Scale 1:150,000

Date: 1-23-06

Drawn by: AES

10:START-3\06010005\fig 1

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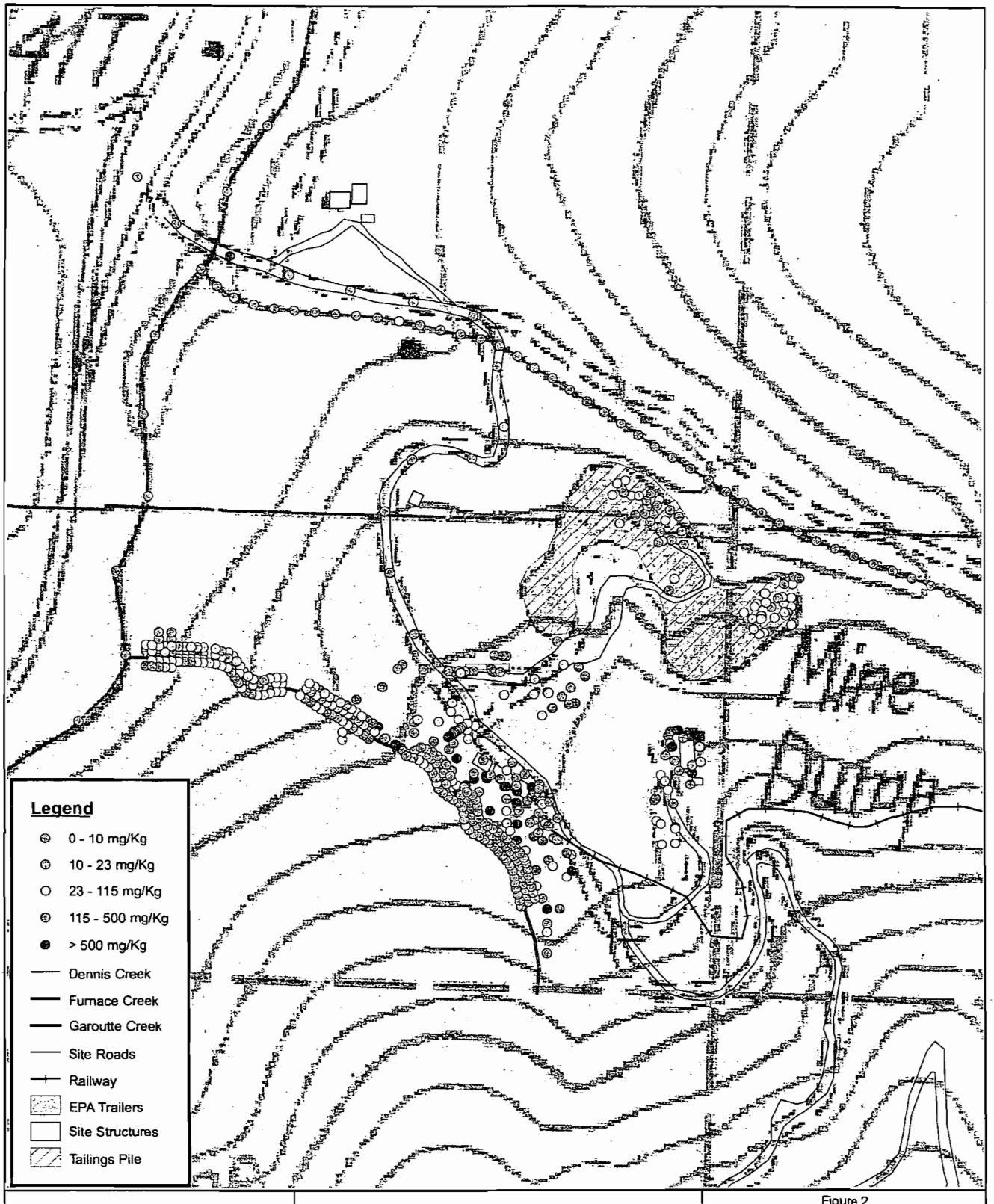
International Specialists in the Environment
Seattle, Washington



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0 50 100 200 300 400 500
Feet
Scale 1:4,000

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International Specialists in the Environment
Portland, Oregon

BLACK BUTTE MINE

Lane County, Oregon

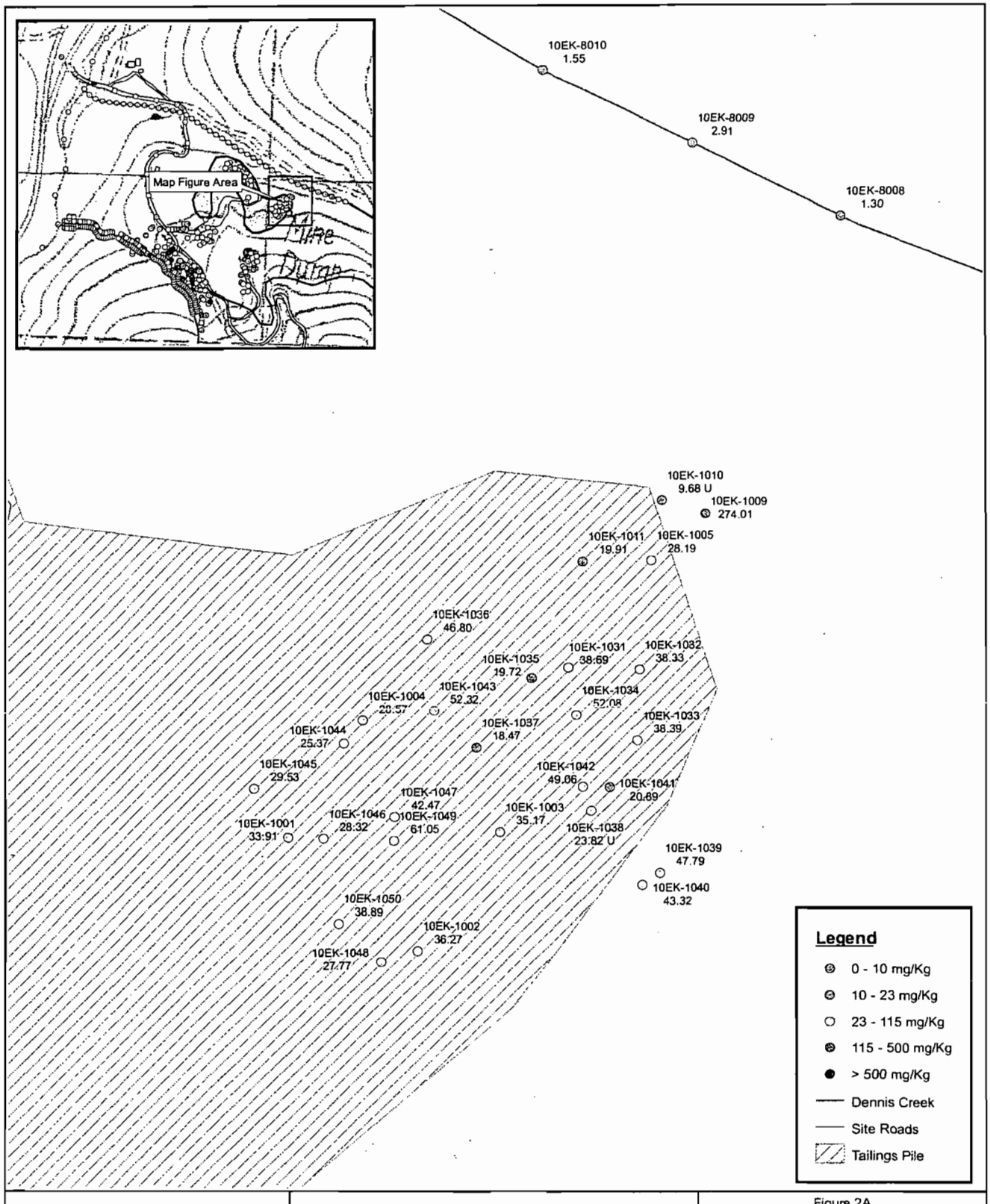
Figure 2

Field Mercury Concentrations Site Map

Job Id: 002233.0026.01IA	
Date: 10/15/2007	GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1 site map.mxd



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Portland, Oregon

BLACK BUTTE MINE

Lane County, Oregon

Figure 2A

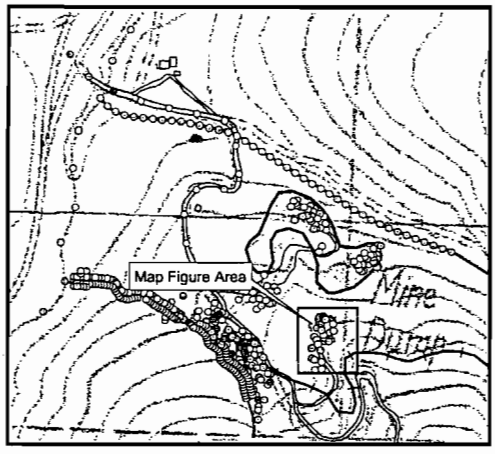
Field Mercury Concentrations
East Main Tailings Pile

Job Id:
002233.0026.01IA

Date:	GIS Analyst:
10/15/2007	avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mineremoval_aug07\Figure 1a.mxd



10EK-2003 136.77
10EK-2001 189.25
10EK-2002 673.01
10EK-2006 185.41
10EK-2008 179.78
10EK-2027 13.89 U
10EK-2004 105.69
10EK-2007 1615.93
10EK-2005 1625.32
10EK-2028 52.5
10EK-2016 649.03
10EK-2010 153.92
10EK-2009 119.28
10EK-2026 11.44 U
10EK-2029 31.4
10EK-2024 19.5
10EK-2025 13.89 U
10EK-2012 111.62
10EK-2015 1000.88
10EK-2017 54.25
10EK-2014 172.20
10EK-2011 94.02
10EK-2018 125.45
10EK-2019 133.90
10EK-2020 65.42
10EK-2013 164.61
10EK-2021 32.62
10EK-2022 63.79
10EK-2039 69.55
10EK-2040 94.08
10EK-2023 62.00
10EK-2038 36.09

Legend

- 0 - 10 mg/Kg
- 10 - 23 mg/Kg
- 23 - 115 mg/Kg
- 115 - 500 mg/Kg
- > 500 mg/Kg
- Site Roads
- Railway
- Site Structures

N W E S

0 5 10 20 30 40 50
Feet

Scale 1:500

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International Specialists in the Environment
Portland, Oregon

BLACK BUTTE MINE

Lane County, Oregon

Figure 2B

Field Mercury Concentrations New Furnace Area

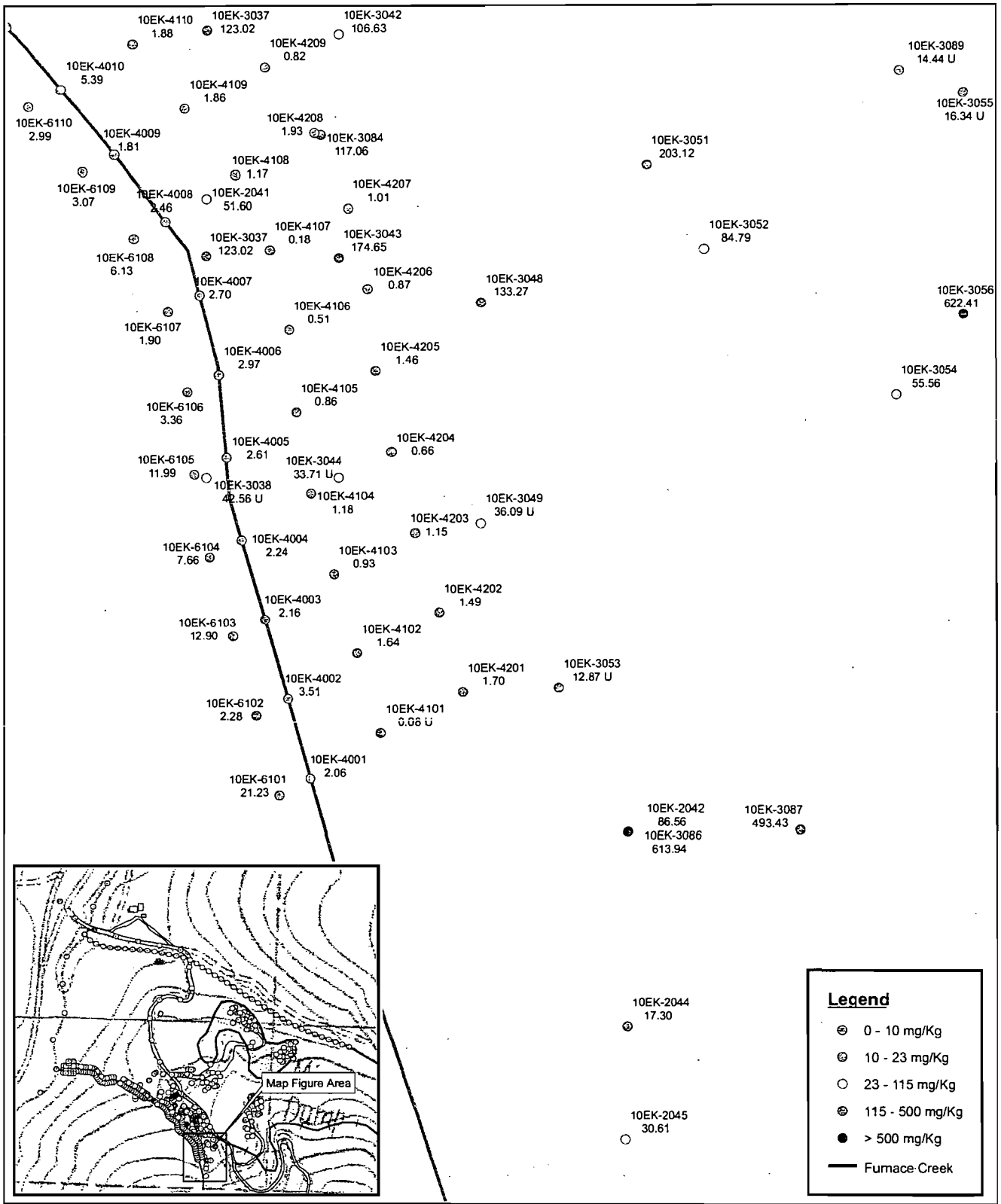
Job Id: 002233.0026.01IA

Date: 10/15/2007

GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1b.mxd



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Feet

Scale 1:300

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Portland, Oregon

BLACK BUTTE MINE

Lane County, Oregon

Figure 2C

Field Mercury Concentrations Furnace Creek Section 1 (East End)

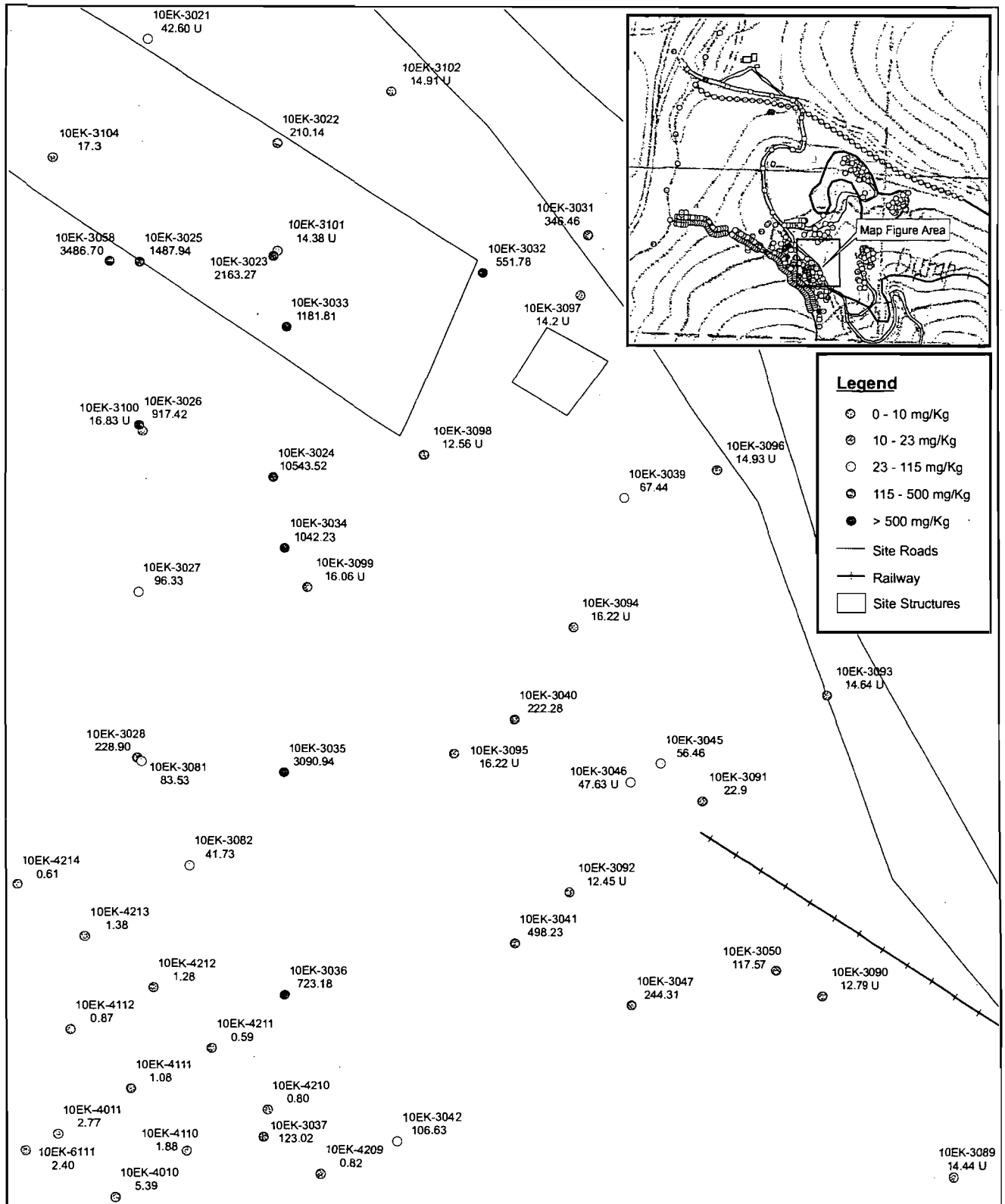
Job Id:
002233.0026.01IA

Date:
10/15/2007

GIS Analyst:
avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1c.mxd



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Portland, Oregon

BLACK BUTTE MINE

Lane County, Oregon

Figure 2D

Field Mercury Concentrations
Old Furnace Area
Furnace Creek Section 2

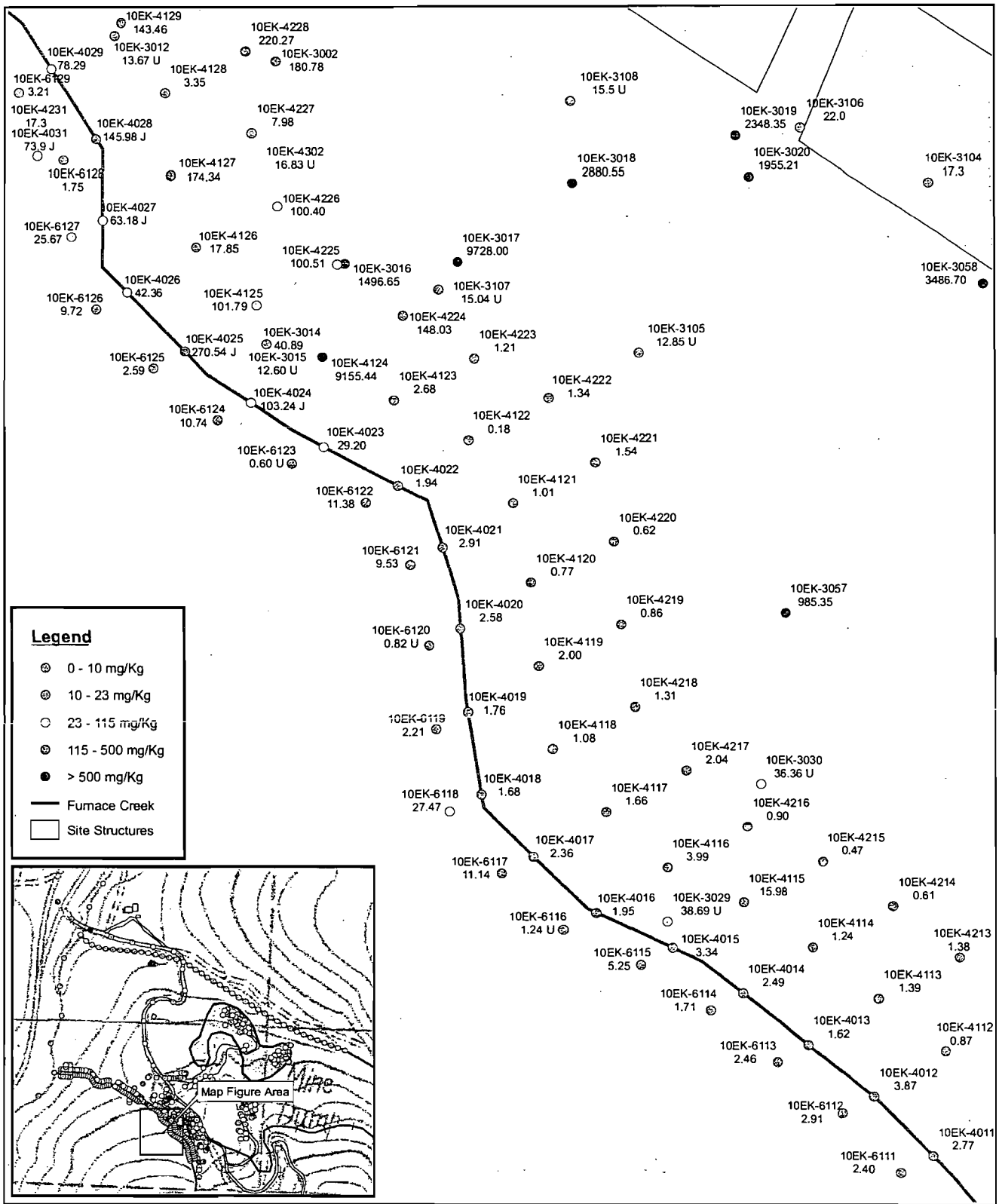
Job Id: 002233.0026.01IA

Date: 10/15/2007

GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1d.mxd



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Portland, Oregon

BLACK BUTTE MINE

Lane County, Oregon

Figure 2E

Field Mercury Concentrations Furnace Creek Section 3

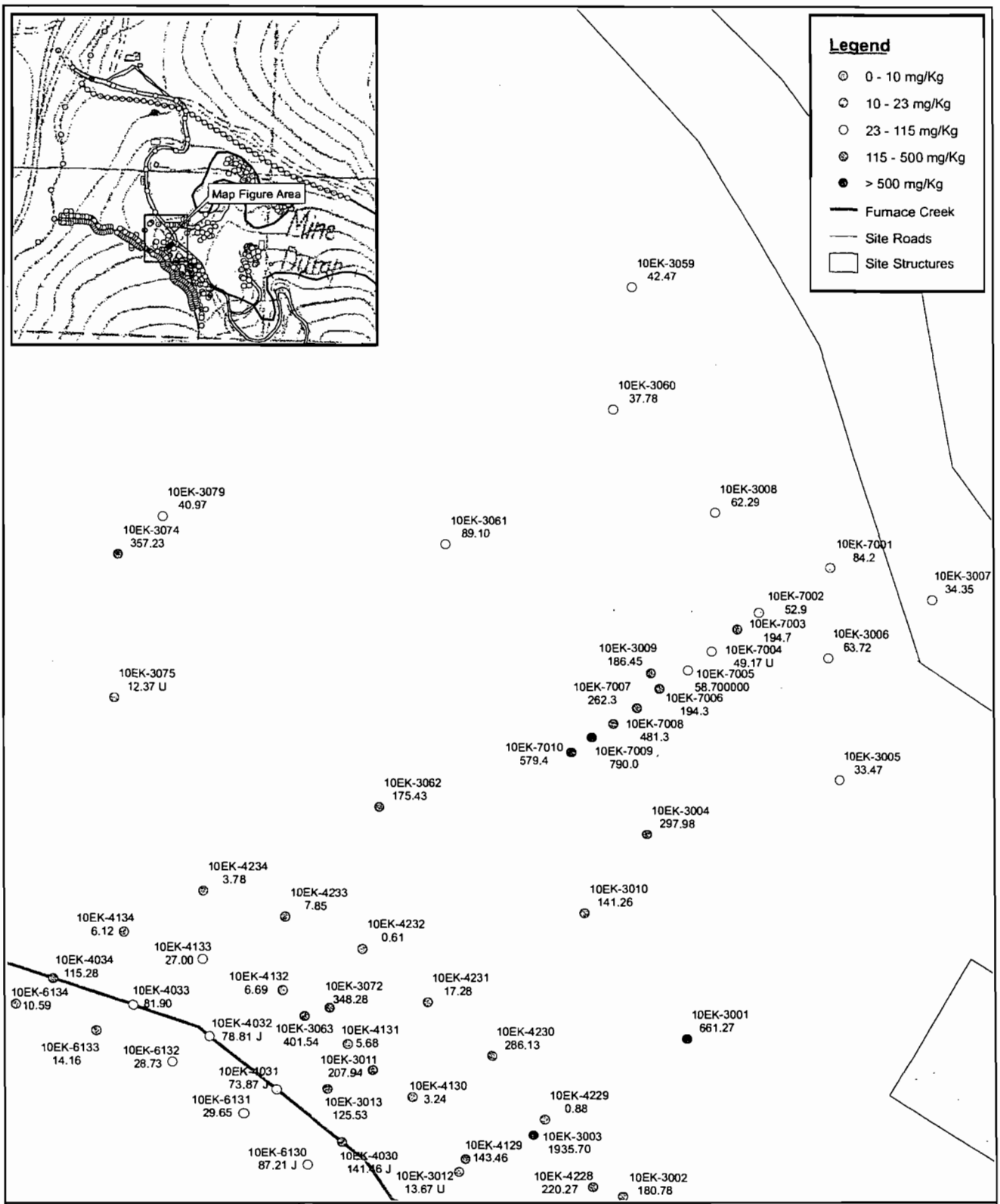
Job Id: 002233.0026.01IA

Date: 10/15/2007

GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\Figure 1e.mxd



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Portland, Oregon

BLACK BUTTE MINE

Lane County, Oregon

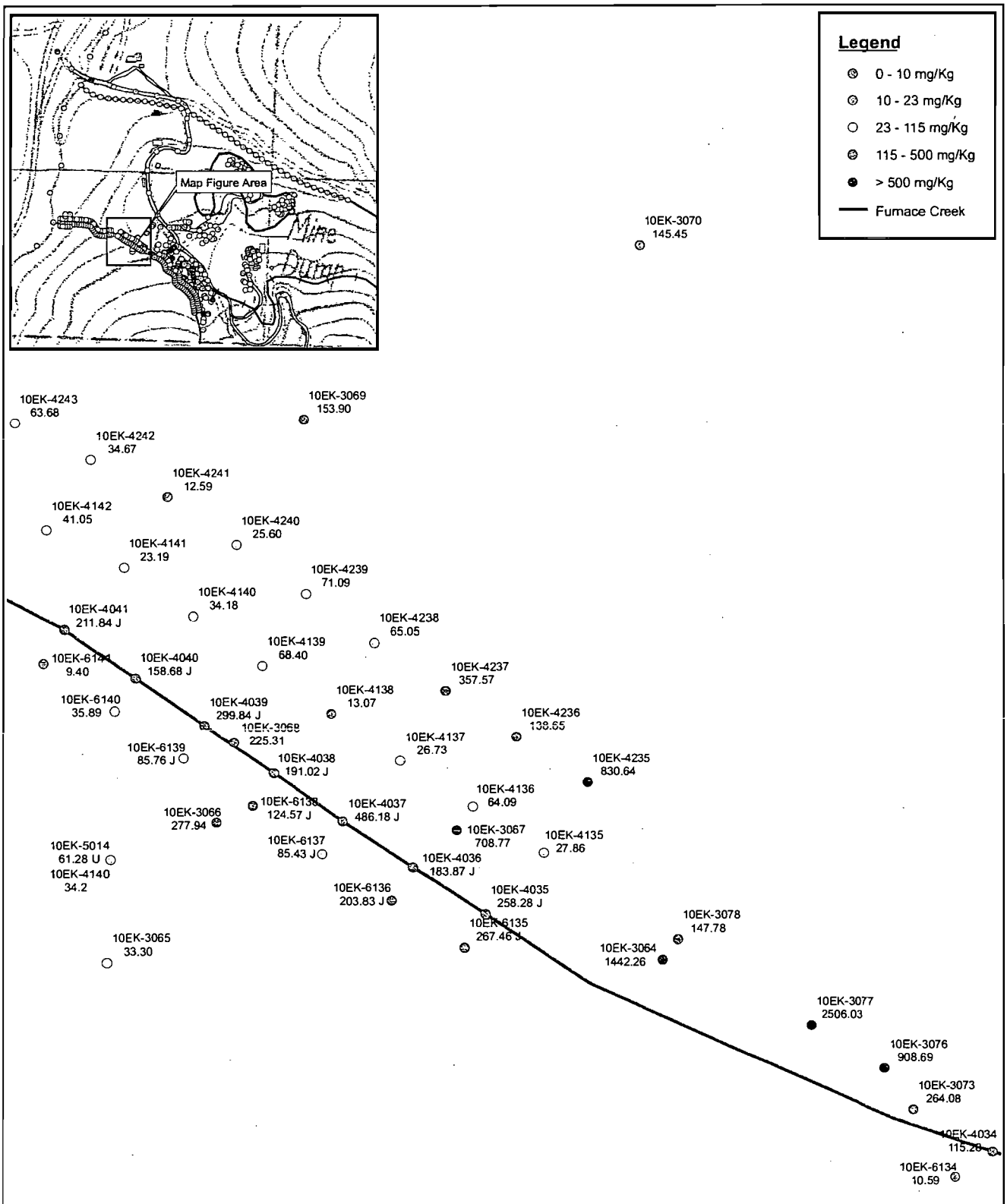
Figure 2F

Field Mercury Concentrations Furnace Creek Section 4

Job Id: 002233.0026.01IA	
Date: 10/15/2007	GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mineremoval_aug07\figure 1f.mxd



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Portland, Oregon

BLACK BUTTE MINE

Lane County, Oregon

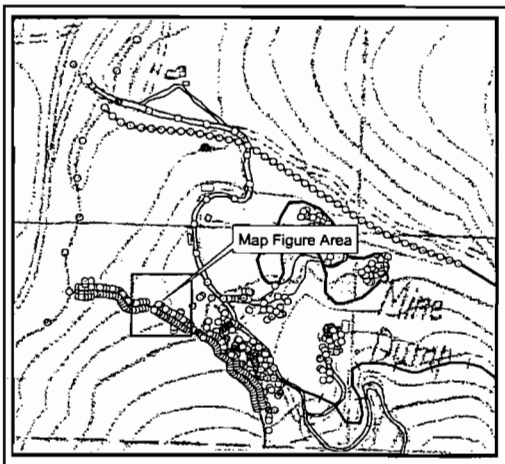
Figure 2G

Field Mercury Concentrations Furnace Creek Section 5

Job Id: 002233.0026.01IA	
Date: 10/15/2007	GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1g.mxd



Legend

- 0 - 10 mg/Kg
- 10 - 23 mg/Kg
- 23 - 115 mg/Kg
- 115 - 500 mg/Kg
- > 500 mg/Kg
- Furnace Creek

10EK-4251 30.73 J
10EK-4250 29.63
10EK-4249 27.94 J
10EK-4151 82.50
10EK-4150 31.89
10EK-4149 52.20
10EK-4051 137.00
10EK-4050 133.18
10EK-4049 150.42
10EK-6151 63.39
10EK-6150 31.55
10EK-6149 34.74
10EK-4248 43.82 J
10EK-4247 106.55
10EK-4148 56.03
10EK-4246 397.23
10EK-4147 20.93
10EK-4048 129.89 J
10EK-4245 27.94
10EK-6148 63.86
10EK-4047 265.35 J
10EK-4146 91.47 J
10EK-4244 45.80
10EK-4145 18.76
10EK-6147 22.93
10EK-4046 228.75 J
10EK-4243 63.68
10EK-4144 26.86
10EK-6146 142.49 J
10EK-4045 108.20 J
10EK-4143 35.78
10EK-6145 29.00
10EK-4044 22.95
10EK-4043 21.10
10EK-6144 55.27
10EK-4042 140.16 J
10EK-6143 204.08 J
10EK-6142 14.72

N W E S

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Feet

Scale 1:300

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BLACK BUTTE MINE

Lane County, Oregon

Figure 2H

Field Mercury Concentrations Furnace Creek Section 6

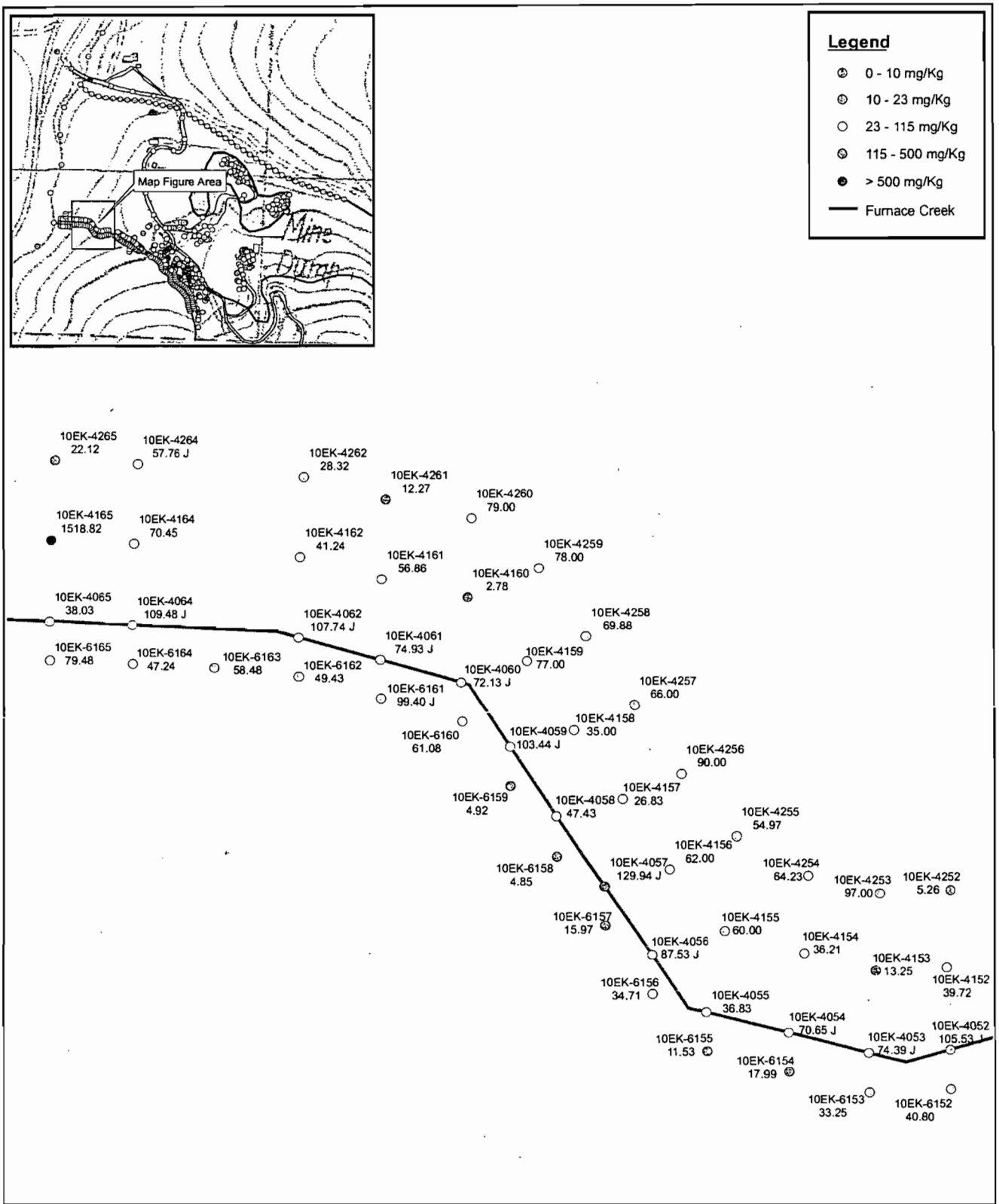
Job Id: 002233.0026.01IA

Date: 10/15/2007

GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1h.mxd



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BLACK BUTTE MINE

Lane County, Oregon

Figure 2I

Field Mercury Concentrations Furnace Creek Section 7

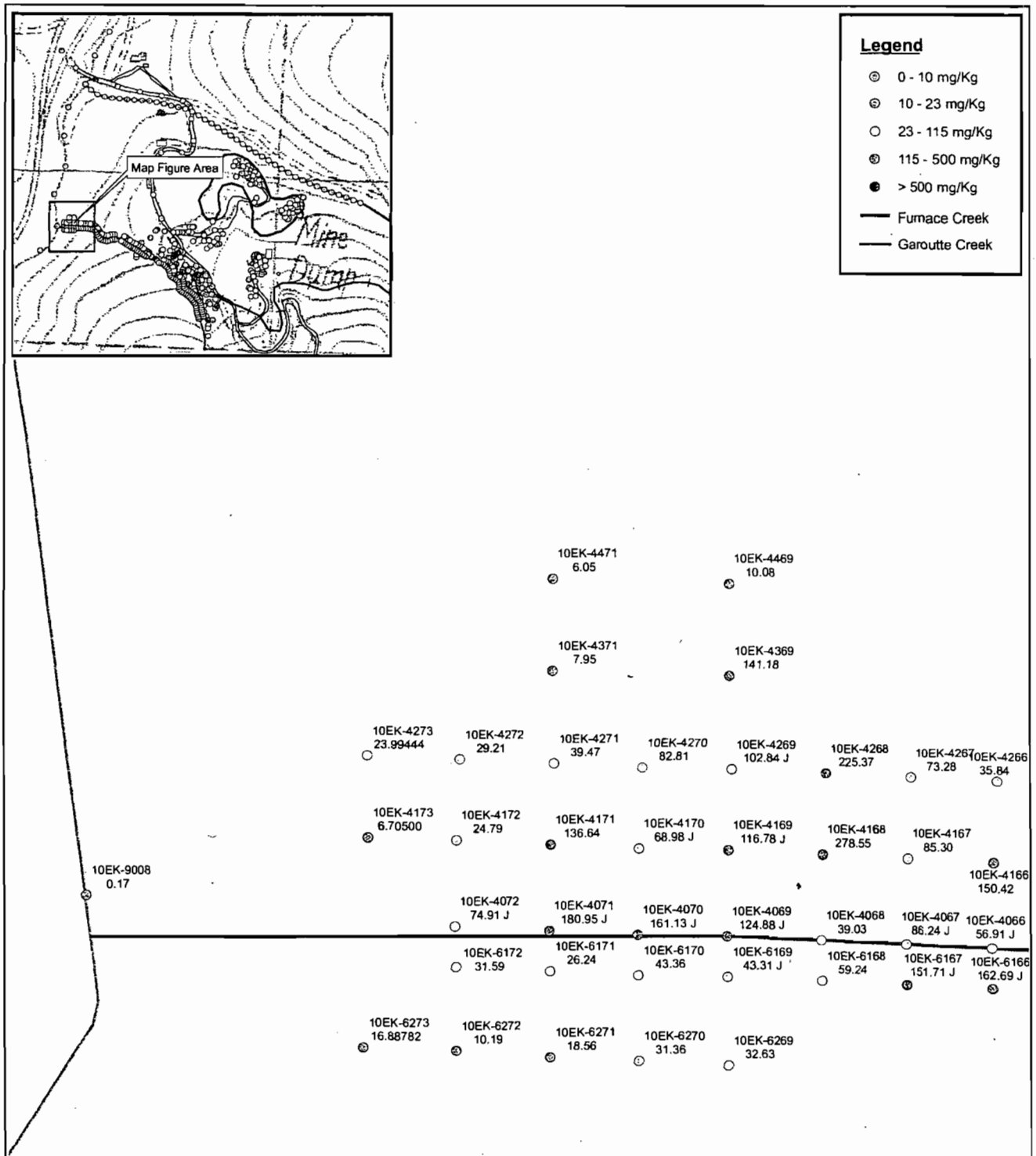
Job Id: 002233.0026.01IA

Date: 10/15/2007

GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1i.mxd



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Feet

Scale 1:300

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BLACK BUTTE MINE

Lane County, Oregon

Figure 2J

Field Mercury Concentrations Furnace Creek Section 8 (West End)

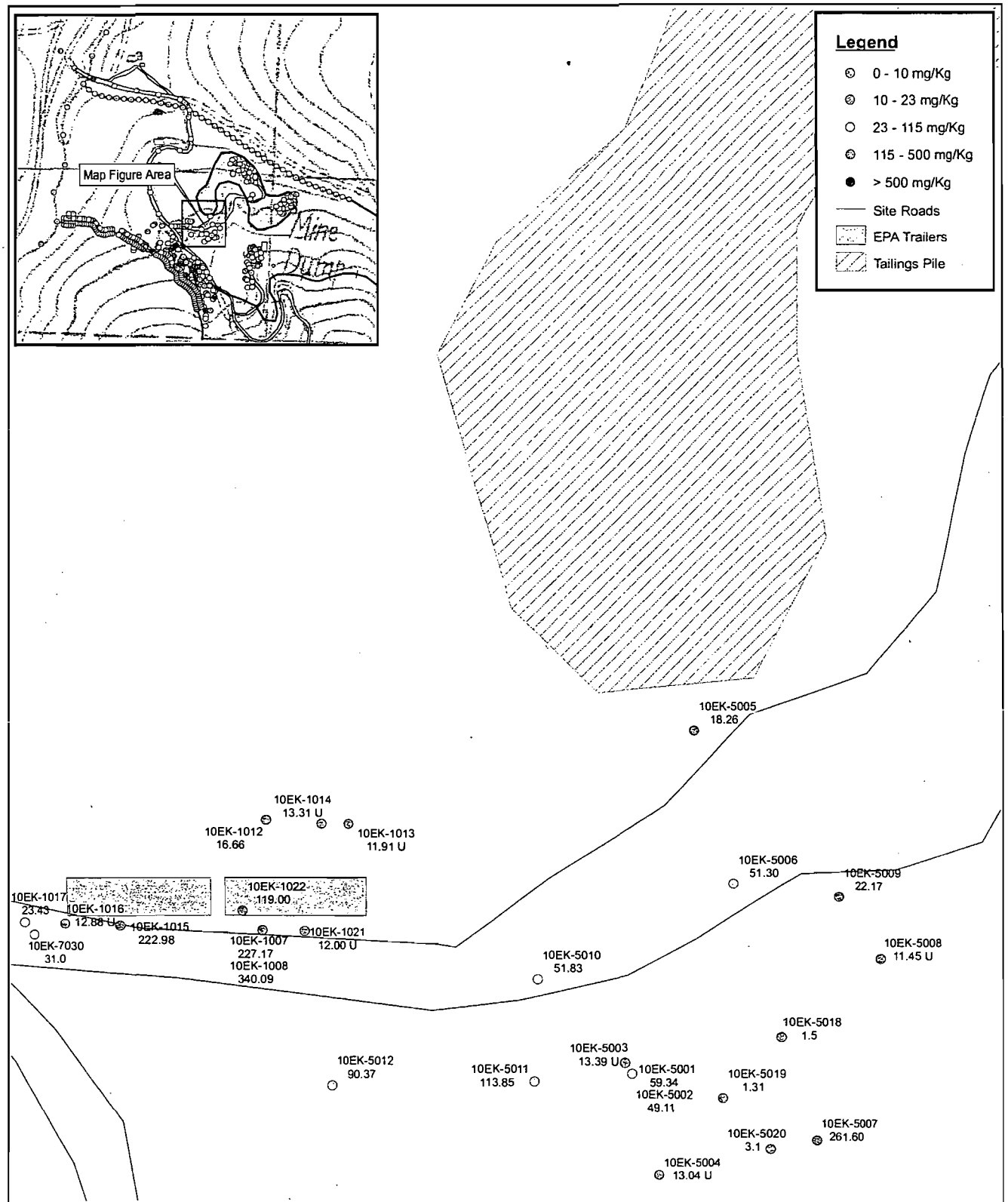
Job Id:
002233.0026.01A

Date:
10/15/2007

GIS Analyst:
avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1j.mxd



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BLACK BUTTE MINE

Lane County, Oregon

Figure 2K

Field Mercury Concentrations EPA Trailers and Repository

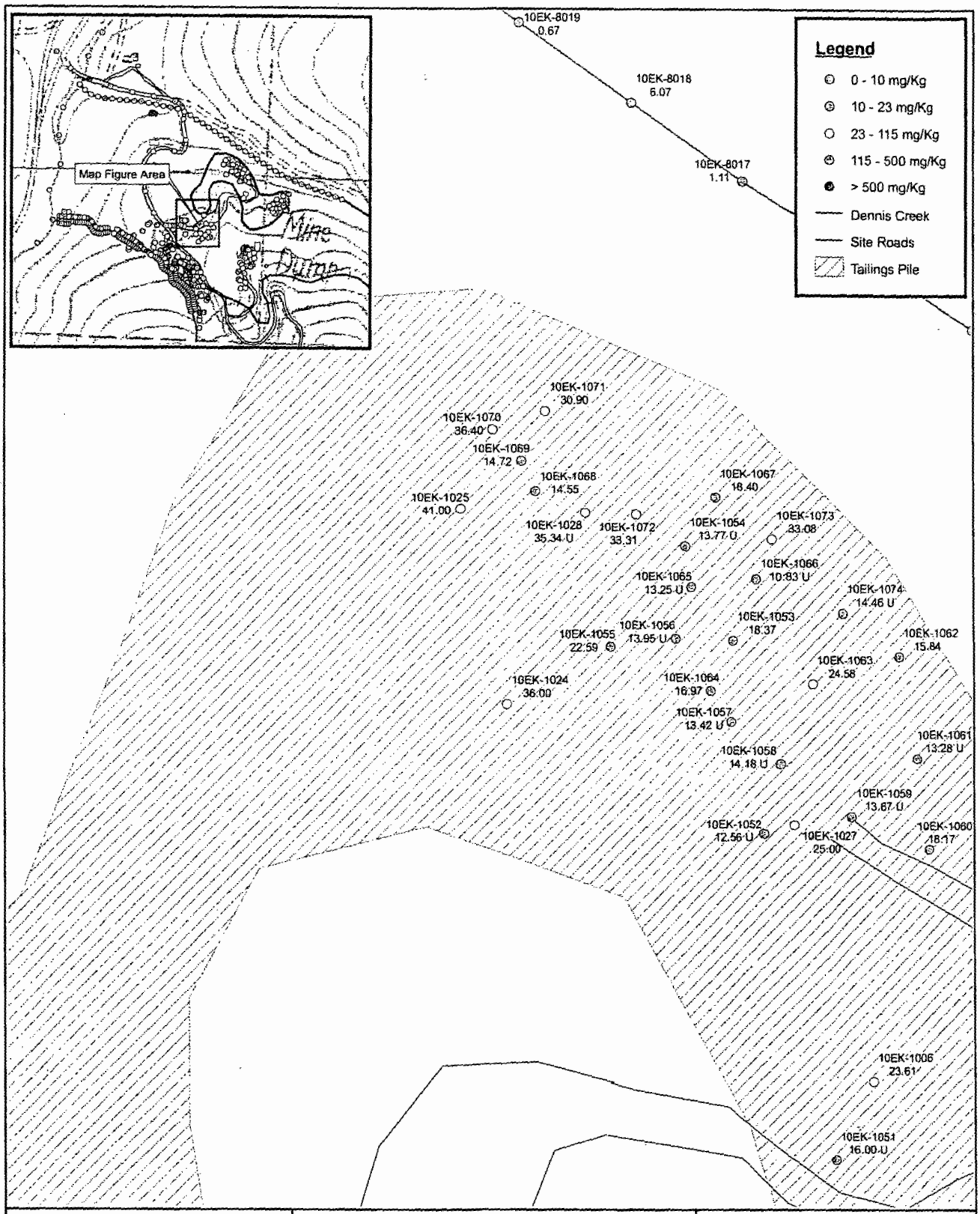
Job Id: 002233.0026.01IA

Date: 10/15/2007

GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1k.mxd



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BLACK BUTTE MINE

Lane County, Oregon

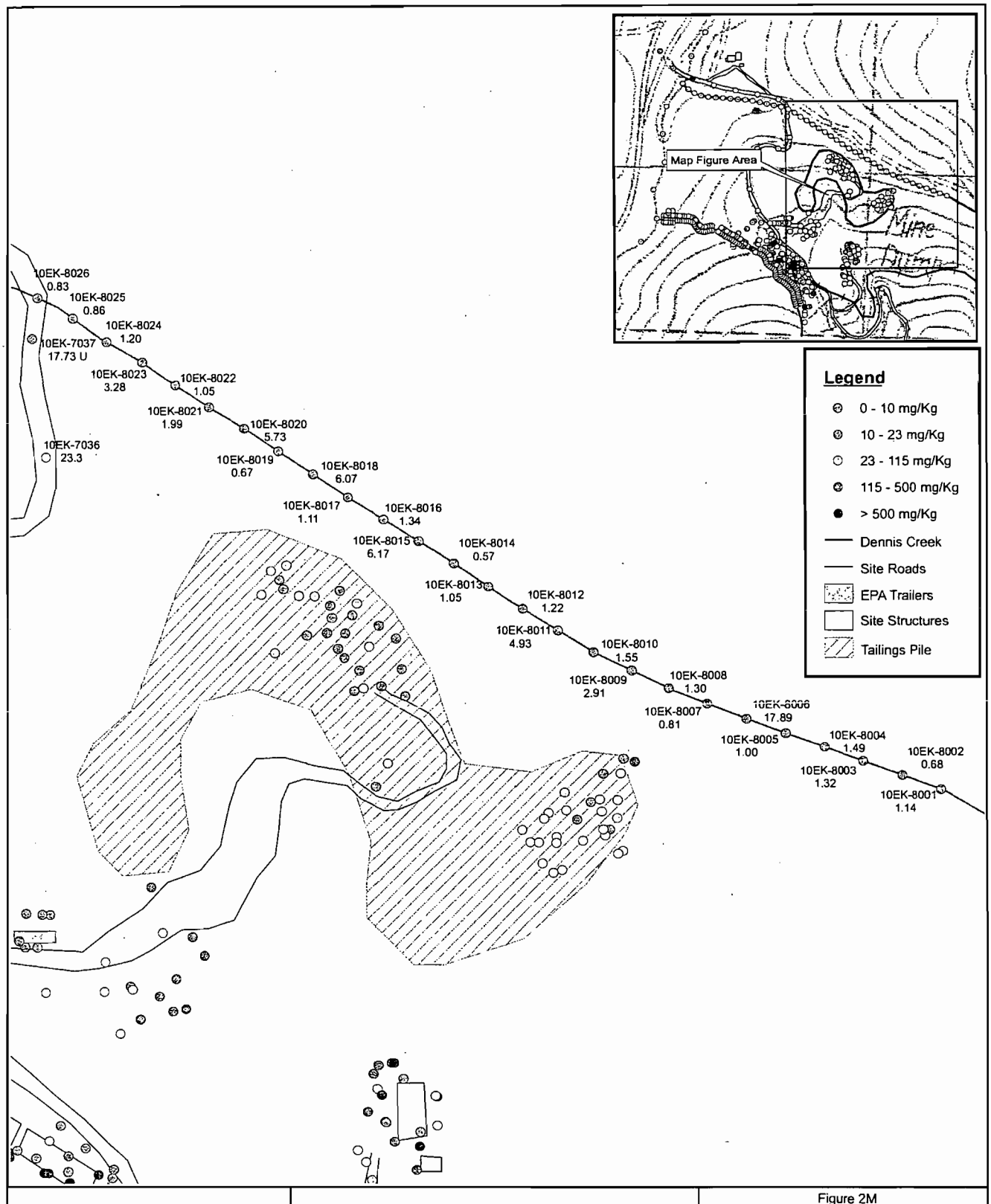
Figure 2L

Field Mercury Concentrations West Main Tailings Pile

Job Id: 002233.0026.01IA	
Date: 10/15/2007	GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1l.mxd



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BLACK BUTTE MINE

Lane County, Oregon

Figure 2M

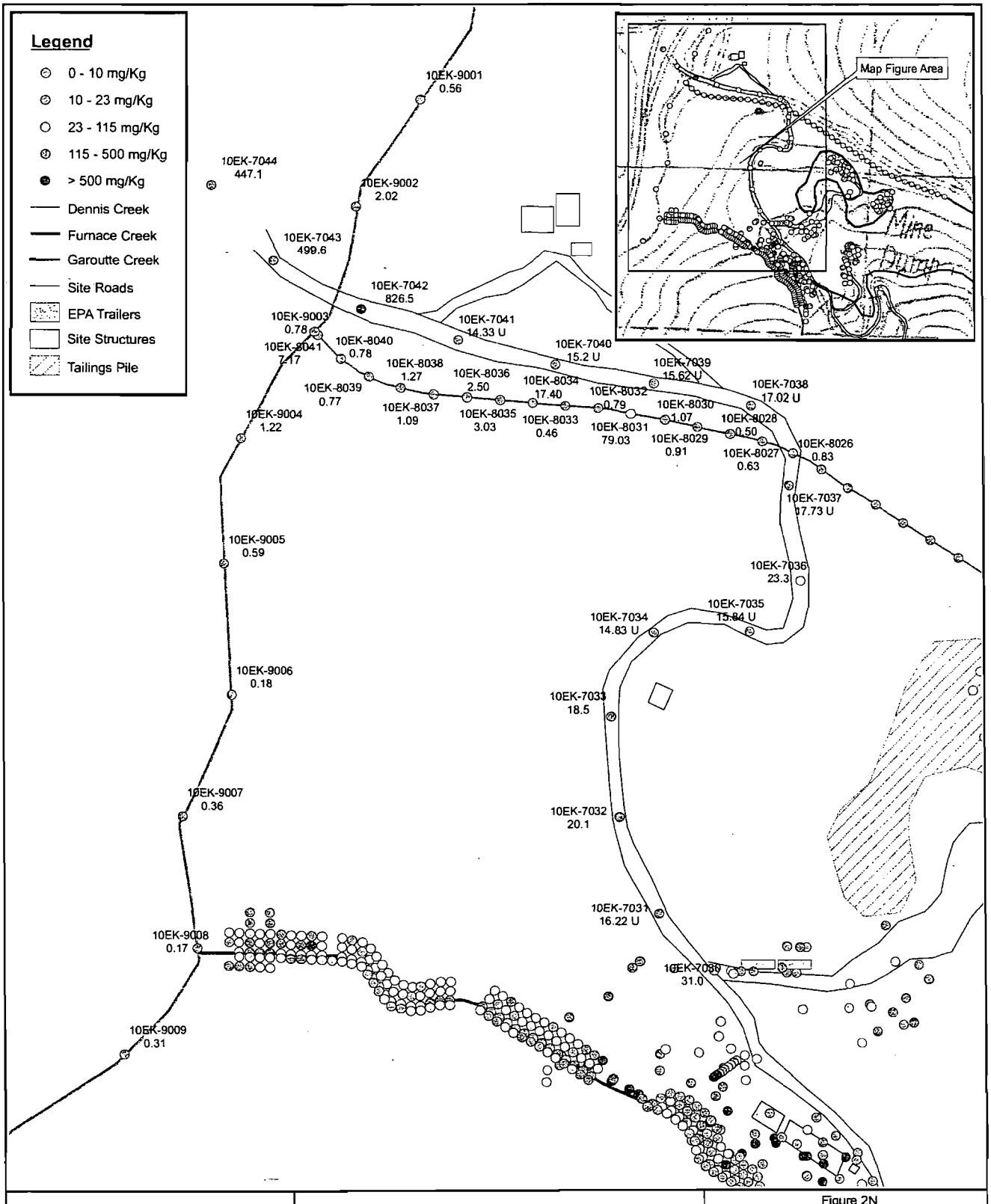
Field Mercury Concentrations Dennis Creek (East End)

Job Id: 002233.0026.011A

Date: 10/15/2007 | GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1m.mxd



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BLACK BUTTE MINE

Lane County, Oregon

Figure 2N

Field Mercury Concentrations Dennis Creek (West End), Garoutte Creek, and Site Road

Job Id: 002233.0026.01IA	
Date: 10/15/2007	GIS Analyst: avh

Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .

\EDMS-Projects\Black Butte Mine\removal_aug07\figure 1n.mxd

Table I-1
TOTAL MERCURY IN TAILINGS SAMPLES FROM MAIN TAILINGS PILE
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
1	10EK-1001	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	33.9	5.80	
2	10EK-1002	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	36.2	5.77	
3	10EK-1003	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	35.2	5.55	
4	10EK-1004	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	28.6	5.13	
5	10EK-1005	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	28.2	5.73	
6	10EK-1006	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	23.6	4.60	
7	10EK-1007	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	227	8.89	
8	10EK-1008	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	340	11.34	
9	10EK-1009	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	274	11.46	
10	10EK-1010	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	9.7	9.68	U
11	10EK-1011	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	19.9	4.63	
12	10EK-1012	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	16.7	4.35	
13	10EK-1013	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	11.9	11.91	U
14	10EK-1014	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	13.3	13.31	U
15	10EK-1015	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	222	11.18	
16	10EK-1016	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	12.9	12.88	U
17	10EK-1017	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	23.4	4.71	
18	10EK-1018	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	11.8	11.83	U
19	10EK-1019	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	11.6	11.61	U
20	10EK-1020	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	12.0	12.00	U
21	10EK-1021	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	12.0	12.00	U
22	10EK-1022	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	119	0.00	
24	10EK-1024	Main Tailings/PreRegrading/West	Tailings	8/24/07	mg/kg	36.0	0.00	
25	10EK-1025	Main Tailings/PreRegrading/West	Tailings	8/24/07	mg/kg	41.0	0.00	
27	10EK-1027	Main Tailings/PreRegrading/West	Tailings	8/24/07	mg/kg	25.0	0.00	
28	10EK-1028	Main Tailings/PreRegrading/West	Tailings	8/25/07	mg/kg	35.3	35.34	U
31	10EK-1031	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	38.7	5.91	
32	10EK-1032	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	38.3	5.93	
33	10EK-1033	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	38.4	5.91	
34	10EK-1034	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	52.1	6.63	
35	10EK-1035	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	19.7	5.29	
36	10EK-1036	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	46.8	6.88	

Table 1-1
TOTAL MERCURY IN TAILINGS SAMPLES FROM MAIN TAILINGS PILE
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
37	10EK-1037	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	18.5	5.19	
38	10EK-1038	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	23.8	23.82	U
39	10EK-1039	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	47.8	6.84	
40	10EK-1040	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	43.3	6.25	
41	10EK-1041	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	20.9	5.26	
42	10EK-1042	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	49.1	6.77	
43	10EK-1043	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	52.3	6.68	
44	10EK-1044	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	25.4	5.82	
45	10EK-1045	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	29.5	5.41	
46	10EK-1046	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	28.3	5.36	
47	10EK-1047	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	42.5	6.30	
48	10EK-1048	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	27.8	5.40	
49	10EK-1049	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	61.1	6.79	
50	10EK-1050	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	38.9	6.33	
51	10EK-1051	Main Tailings/Confirmation Sampling/West	Tailings	8/31/07	mg/kg	16.0	16.00	U
52	10EK-1052	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	12.6	12.56	U
53	10EK-1053	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	18.4	4.64	
54	10EK-1054	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	13.8	13.77	U
55	10EK-1055	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	22.6	5.91	
56	10EK-1056	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	14.0	13.95	U
57	10EK-1057	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	13.4	13.42	U
58	10EK-1058	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	14.2	14.18	U
59	10EK-1059	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	13.7	13.67	U
60	10EK-1060	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	18.2	4.80	
61	10EK-1061	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	13.3	13.28	U
62	10EK-1062	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	15.8	4.67	
63	10EK-1063	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	24.6	5.15	
64	10EK-1064	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	17.0	4.92	
65	10EK-1065	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	13.3	13.25	U
66	10EK-1066	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	10.8	10.83	U
67	10EK-1067	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	18.4	4.82	
68	10EK-1068	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	14.6	4.50	

Table I-1
TOTAL MERCURY IN TAILINGS SAMPLES FROM MAIN TAILINGS PILE
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
69	10EK-1069	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	14.7	4.78	
70	10EK-1070	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	36.4	5.73	
71	10EK-1071	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	30.9	5.18	
72	10EK-1072	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	33.3	5.56	
73	10EK-1073	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	33.1	5.16	
74	10EK-1074	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	14.5	14.46	U

Key: mg/kg = milligrams per kilogram
U = not detected above this concentration
XRF = X-ray Flourescence

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Table I-2
TOTAL MERCURY IN SAMPLES FROM OLD ORE FURNACE AREA
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
121	10EK-3001	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	661	18.86	
122	10EK-3002	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	181	9.66	
123	10EK-3003	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	1940	32.34	
124	10EK-3004	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	298	11.99	
125	10EK-3005	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	33.5	5.66	
126	10EK-3006	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	63.7	7.09	
127	10EK-3007	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	34.4	5.93	
128	10EK-3008	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	62.3	7.20	
129	10EK-3009	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	186	9.50	
130	10EK-3010	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	141	10.38	
131	10EK-3011	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	208	10.44	
132	10EK-3012	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	13.7	13.67	U
133	10EK-3013	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	126	9.14	
134	10EK-3014	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	40.9	5.72	
135	10EK-3015	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	12.6	12.60	U
136	10EK-3016	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	1500	29.03	
137	10EK-3017	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	9730	109.93	
138	10EK-3018	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	2880	41.06	
139	10EK-3019	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	2350	36.16	
140	10EK-3020	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	1960	32.03	
141	10EK-3021	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	42.6	42.60	U
142	10EK-3022	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	210	29.27	
143	10EK-3023	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	2160	76.39	
144	10EK-3024	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	10500	319.74	
145	10EK-3025	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	1490	66.14	
146	10EK-3026	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	917	58.57	
147	10EK-3027	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	96.3	23.63	
148	10EK-3028	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	229	24.15	
149	10EK-3029	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	38.7	38.69	U
150	10EK-3030	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	36.4	36.36	U
151	10EK-3031	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	346	30.60	
152	10EK-3032	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	552	41.01	

Table I-2
TOTAL MERCURY IN SAMPLES FROM OLD ORE FURNACE AREA
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
153	10EK-3033	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	1180	61.40	
154	10EK-3034	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	1040	70.80	
155	10EK-3035	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	3090	127.80	
156	10EK-3036	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	723	48.87	
157	10EK-3037	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	123	21.08	
157	10EK-3037	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	123	21.08	
158	10EK-3038	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	42.6	42.56	U
159	10EK-3039	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	67.4	18.44	
160	10EK-3040	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	222	23.80	
161	10EK-3041	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	498	51.49	
162	10EK-3042	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	107	21.00	
163	10EK-3043	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	175	24.17	
164	10EK-3044	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	33.7	33.71	U
165	10EK-3045	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	56.5	16.11	
166	10EK-3046	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	47.6	47.63	U
167	10EK-3047	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	244	26.44	
168	10EK-3048	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	133	26.93	
169	10EK-3049	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	36.1	36.09	U
170	10EK-3050	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	118	21.44	
171	10EK-3051	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	203	10.55	
172	10EK-3052	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	84.8	7.57	
173	10EK-3053	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	12.9	12.87	U
174	10EK-3054	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	55.6	6.31	
175	10EK-3055	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	16.3	16.34	U
176	10EK-3056	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	622	18.90	
177	10EK-3057	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	985	20.15	
178	10EK-3058	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	3490	47.17	
179	10EK-3059	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	42.5	5.79	
180	10EK-3060	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	37.8	6.29	
181	10EK-3061	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	89.1	7.83	
182	10EK-3062	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	175	10.01	
183	10EK-3063	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	402	14.11	

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Table I-2
TOTAL MERCURY IN SAMPLES FROM OLD ORE FURNACE AREA
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
184	10EK-3064	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	1440	31.19	
185	10EK-3065	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	33.3	5.52	
186	10EK-3066	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	278	12.55	
187	10EK-3067	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	709	18.15	
188	10EK-3068	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	225	10.31	
189	10EK-3069	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	154	8.71	
190	10EK-3070	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	145	8.67	
191	10EK-3071	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	148	8.67	
192	10EK-3072	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	348	13.88	
193	10EK-3073	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	264	11.86	
194	10EK-3074	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	357	13.33	
195	10EK-3075	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	12.4	12.37	U
196	10EK-3076	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	909	21.25	
197	10EK-3077	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	2510	40.44	
198	10EK-3078	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	148	9.42	
199	10EK-3079	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	41.0	6.23	
201	10EK-3081	Old Ore Furnace/Upgradient	Tailings	8/30/07	mg/kg	83.5	7.71	
202	10EK-3082	Old Ore Furnace/Upgradient	Tailings	8/30/07	mg/kg	41.7	5.57	
204	10EK-3084	Old Ore Furnace/Upgradient	Tailings	8/30/07	mg/kg	117	7.74	
206	10EK-3086	Old Ore Furnace/Upgradient	Tailings	8/30/07	mg/kg	614	15.56	
207	10EK-3087	Old Ore Furnace/Upgradient	Tailings	8/30/07	mg/kg	493	14.28	
619	10EK-3089	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.4	14.44	U
620	10EK-3090	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	12.8	12.79	U
621	10EK-3091	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	22.9	6.54	
622	10EK-3092	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	12.5	12.45	U
623	10EK-3093	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.6	14.64	U
624	10EK-3094	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	16.2	16.22	U
625	10EK-3095	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	16.2	16.22	U
626	10EK-3096	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.9	14.93	U
627	10EK-3097	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.2	14.20	U
628	10EK-3098	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	12.6	12.56	U
629	10EK-3099	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	16.1	16.06	U

Table I-2
TOTAL MERCURY IN SAMPLES FROM OLD ORE FURNACE AREA
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
630	10EK-3100	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	16.8	16.83	U
631	10EK-3101	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.4	14.38	U
632	10EK-3102	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.9	14.91	U
633	10EK-3103	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	16.1	16.11	U
634	10EK-3104	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	17.3	4.88	
635	10EK-3105	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	12.9	12.85	U
636	10EK-3106	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	22.0	5.79	
637	10EK-3107	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	15.0	15.04	U
638	10EK-3108	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	15.5	15.50	U
639	10EK-3109	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	15.0	15.04	U
552	10EK-7001	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	84	18.45	
553	10EK-7002	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	53	15.17	
554	10EK-7003	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	195	29.05	
555	10EK-7004	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg		49.17	U
556	10EK-7005	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	59	15.51	
557	10EK-7006	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	194	25.55	
558	10EK-7007	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	262	32.42	
559	10EK-7008	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	481	39.84	
560	10EK-7009	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	790	55.97	
561	10EK-7010	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	579	37.83	
562	10EK-7011	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	111	19.82	
563	10EK-7012	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	1205	63.26	
564	10EK-7013	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	1124	64.25	

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TABLE I-3
TOTAL MERCURY IN SAMPLES FROM NEW FURNACE AREA
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
75	10EK-2001	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	189	10.38	
76	10EK-2002	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	673	15.93	
77	10EK-2003	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	137	7.23	
78	10EK-2004	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	106	6.93	
79	10EK-2005	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	1630	28.55	
80	10EK-2006	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	185	9.05	
81	10EK-2007	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	1620	29.45	
82	10EK-2008	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	180	8.96	
83	10EK-2009	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	119	7.69	
84	10EK-2010	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	154	8.46	
85	10EK-2011	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	94	7.01	
86	10EK-2012	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	112	7.66	
87	10EK-2013	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	165	8.41	
88	10EK-2014	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	172	8.66	
89	10EK-2015	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	1000	20.32	
90	10EK-2016	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	649	16.20	
91	10EK-2017	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	54.3	5.89	
92	10EK-2018	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	125	7.28	
93	10EK-2019	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	134	7.99	
94	10EK-2020	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	65.4	5.92	
95	10EK-2021	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	32.6	6.57	
96	10EK-2022	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	63.8	6.12	
97	10EK-2023	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	62.0	6.29	
98	10EK-2024	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	19.5	4.85	
99	10EK-2025	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	13.9	13.89	U
100	10EK-2026	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	11.4	11.44	U
101	10EK-2027	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	13.9	13.89	U
102	10EK-2028	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	52.5	6.30	
103	10EK-2029	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	31.4	5.94	
112	10EK-2038	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	36.1	5.31	
113	10EK-2039	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	69.6	6.83	
114	10EK-2040	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	94.1	6.27	

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TABLE I-3
TOTAL MERCURY IN SAMPLES FROM NEW FURNACE AREA
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
115	10EK-2041	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	51.6	5.83	
116	10EK-2042	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	86.6	6.73	
118	10EK-2044	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	17.3	4.73	
119	10EK-2045	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	30.6	5.09	
120	10EK-2046	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	19.4	4.61	

Key: mg/kg = milligrams per kilogram
U = not detected above this concentration
XRF = X-ray Flouresecence

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TABLE I-4
TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
209	10EK-4001	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.06	0.50	
210	10EK-4002	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	3.51	0.50	
211	10EK-4003	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.16	0.50	
212	10EK-4004	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.24	0.50	
213	10EK-4005	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.61	0.50	
214	10EK-4006	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.97	0.50	
215	10EK-4007	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.70	0.50	
216	10EK-4008	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.46	0.50	
217	10EK-4009	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.81	0.50	
218	10EK-4010	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	5.39	0.50	
219	10EK-4011	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.77	0.50	
220	10EK-4012	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	3.87	0.50	
221	10EK-4013	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.62	0.50	
222	10EK-4014	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.49	0.50	
223	10EK-4015	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	3.34	0.50	
224	10EK-4016	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.95	0.50	
225	10EK-4017	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.36	0.50	
226	10EK-4018	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.68	0.50	
227	10EK-4019	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.76	0.50	
228	10EK-4020	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.58	0.50	
229	10EK-4021	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.91	0.50	
231	10EK-4022	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.94	0.50	
232	10EK-4023	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	29.2	0.50	
233	10EK-4024	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	103	0.50	
234	10EK-4025	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	271	0.50	J
235	10EK-4026	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	42.4	0.50	
236	10EK-4027	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	63.2	0.50	
237	10EK-4028	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	146	0.50	
238	10EK-4029	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	78.3	0.50	
239	10EK-4030	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	141	0.50	
240	10EK-4031	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	73.9	0.50	

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TABLE 1-4
TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
	10EK-4031	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	73.9	0.50	
241	10EK-4032	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	78.8	0.50	
242	10EK-4033	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	81.9	0.50	
243	10EK-4034	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	115	0.50	
244	10EK-4035	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	258	0.50	J
245	10EK-4036	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	184	0.50	J
246	10EK-4037	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	486	0.50	J
247	10EK-4038	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	191	0.50	J
248	10EK-4039	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	300	0.50	J
249	10EK-4040	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	159	0.50	J
250	10EK-4041	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	212	0.50	J
251	10EK-4042	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	140	0.50	
252	10EK-4043	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	21.1	0.50	
253	10EK-4044	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	23.0	0.50	
254	10EK-4045	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	108	0.50	
255	10EK-4046	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	229	0.50	J
256	10EK-4047	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	265	0.50	J
257	10EK-4048	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	130	0.50	
258	10EK-4049	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	150	0.50	
259	10EK-4050	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	133	0.50	
260	10EK-4051	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	138	0.50	
261	10EK-4052	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	106	0.50	
262	10EK-4053	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	74.4	0.50	
263	10EK-4054	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	70.7	0.50	
264	10EK-4055	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	36.8	0.50	
265	10EK-4056	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	87.5	0.50	
266	10EK-4057	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	130	0.50	
267	10EK-4058	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	47.4	0.50	
269	10EK-4059	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	103	0.50	
270	10EK-4060	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	72.1	0.50	
271	10EK-4061	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	74.9	0.50	

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TABLE I-4
TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
272	10EK-4062	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	108	0.50	
273	10EK-4064	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	109	0.50	
274	10EK-4065	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	38.0	0.50	
275	10EK-4066	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	56.9	0.50	
276	10EK-4067	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	86.2	0.50	
277	10EK-4068	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	39.0	0.50	
278	10EK-4069	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	70.8	5.61	
279	10EK-4070	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	104	6.75	
280	10EK-4071	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	181	0.50	J
281	10EK-4072	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	74.9	0.50	
282	10EK-4101	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.08	0.50	U
283	10EK-4102	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.64	0.50	
284	10EK-4103	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.93	0.50	
285	10EK-4104	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.18	0.50	
286	10EK-4105	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.86	0.50	
287	10EK-4106	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.51	0.50	
288	10EK-4107	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.18	0.50	U
289	10EK-4108	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.17	0.50	
290	10EK-4109	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.86	0.50	
291	10EK-4110	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.88	0.50	
292	10EK-4111	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.08	0.50	
293	10EK-4112	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.87	0.50	
294	10EK-4113	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.39	0.50	
295	10EK-4114	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.24	0.50	
296	10EK-4115	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	16.0	0.50	
297	10EK-4116	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	3.99	0.50	
298	10EK-4117	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.66	0.50	
299	10EK-4118	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.08	0.50	
300	10EK-4119	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	2.00	0.50	
301	10EK-4120	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.77	0.50	
302	10EK-4121	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.01	0.50	

TABLE I-4
TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
303	10EK-4122	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.18	0.50	U
304	10EK-4123	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	10.6	10.60	U
305	10EK-4124	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	9160	107.27	
306	10EK-4125	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
307	10EK-4126	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	45.2	5.67	
308	10EK-4127	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
309	10EK-4128	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	55.0	6.01	
310	10EK-4129	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
311	10EK-4130	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	3.24	0.50	
312	10EK-4131	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	5.68	0.50	
313	10EK-4132	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	6.69	0.50	
314	10EK-4133	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	27.0	0.50	
315	10EK-4134	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	6.12	0.50	
316	10EK-4135	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	30.7	5.39	
317	10EK-4136	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
318	10EK-4137	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	26.7	0.50	
319	10EK-4138	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	14.3	14.27	U
320	10EK-4139	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
321	10EK-4140	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	34.2	0.50	
	10EK-4140	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	34.2	0.50	
322	10EK-4141	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	23.2	0.50	
323	10EK-4142	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	41.1	0.50	
324	10EK-4143	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	35.8	0.50	
325	10EK-4144	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	26.9	0.50	
326	10EK-4145	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	18.8	0.50	
327	10EK-4146	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	91.5	0.50	
328	10EK-4147	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	20.9	0.50	
329	10EK-4148	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	56.0	0.50	
330	10EK-4149	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	52.2	0.50	
331	10EK-4150	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	31.9	0.50	
332	10EK-4151	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	82.5	6.73	

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TABLE I-4
TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
333	10EK-4152	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	39.7	0.50	
334	10EK-4153	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	13.3	0.50	
335	10EK-4154	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	36.2	0.50	
336	10EK-4155	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	60.0	0.00	
337	10EK-4156	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	62.0	0.00	
338	10EK-4157	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	26.8	0.50	
339	10EK-4158	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	35.0	0.00	
340	10EK-4159	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	77.0	0.00	
341	10EK-4160	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	2.78	0.50	
342	10EK-4161	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	56.9	0.50	
343	10EK-4162	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	41.2	0.50	
344	10EK-4164	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	70.5	7.34	
345	10EK-4165	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	1520	25.52	
346	10EK-4166	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	150	8.39	
347	10EK-4167	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	85.3	7.14	
348	10EK-4168	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	279	10.76	
349	10EK-4169	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	117	0.50	
350	10EK-4170	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	69.0	0.50	
351	10EK-4171	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	137	8.15	
352	10EK-4172	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	24.8	0.50	
353	10EK-4173	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	6.71	0.50	
354	10EK-4201	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.70	0.50	
355	10EK-4202	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.49	0.50	
356	10EK-4203	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.15	0.50	
357	10EK-4204	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.66	0.50	
358	10EK-4205	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.46	0.50	
359	10EK-4206	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.87	0.50	
360	10EK-4207	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.01	0.50	
361	10EK-4208	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.93	0.50	
362	10EK-4209	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.82	0.50	
363	10EK-4210	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.80	0.50	

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TABLE I-4
TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
364	10EK-4211	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.59	0.50	
365	10EK-4212	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.28	0.50	
366	10EK-4213	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.38	0.50	
367	10EK-4214	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.61	0.50	
368	10EK-4215	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.47	0.50	U
369	10EK-4216	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.90	0.50	
370	10EK-4217	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	2.04	0.50	
371	10EK-4218	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.31	0.50	
372	10EK-4219	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.86	0.50	
373	10EK-4220	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.62	0.50	
374	10EK-4221	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.54	0.50	
375	10EK-4222	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.34	0.50	
376	10EK-4223	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.21	0.50	
377	10EK-4224	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	148	8.23	
378	10EK-4225	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	101	7.38	
379	10EK-4226	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	100	7.46	
380	10EK-4227	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	7.98	0.50	
381	10EK-4228	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	220	10.87	
382	10EK-4229	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.88	0.50	
383	10EK-4230	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	286	11.96	
384	10EK-4231	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	17.3	0.50	
	10EK-4231	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	17	0.50	
385	10EK-4232	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.61	0.50	
386	10EK-4233	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	7.85	0.50	
387	10EK-4234	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	3.78	0.50	
388	10EK-4235	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
389	10EK-4236	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	139	8.59	
390	10EK-4237	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	358	12.35	
391	10EK-4238	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	47.6	5.73	
392	10EK-4239	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
393	10EK-4240	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	37.1	5.21	

TABLE I-4
TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
394	10EK-4241	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	12.6	0.50	
395	10EK-4242	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	34.7	0.50	
396	10EK-4243	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
397	10EK-4244	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	54.7	5.90	
398	10EK-4245	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	27.9	0.50	
399	10EK-4246	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
400	10EK-4247	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	107	5.55	
401	10EK-4248	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	36.0	5.01	
402	10EK-4249	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	27.9	0.50	
403	10EK-4250	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	29.6	0.50	
404	10EK-4251	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	30.7	0.50	
405	10EK-4252	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	5.26	0.50	
406	10EK-4253	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.50	
407	10EK-4254	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	40.0	0.00	
408	10EK-4255	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	55.0	0.50	
409	10EK-4256	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	0.00	0.50	
410	10EK-4257	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	66.0	0.00	
411	10EK-4258	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	51.0	0.00	
412	10EK-4259	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	0.00	0.50	
413	10EK-4260	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	79.0	0.00	
414	10EK-4261	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	18.4	4.87	
415	10EK-4262	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	28.3	0.50	
416	10EK-4264	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	57.8	0.50	
417	10EK-4265	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	22.1	0.50	
418	10EK-4266	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	35.8	0.50	
419	10EK-4267	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	0.00	0.50	
420	10EK-4268	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	225	10.17	
421	10EK-4269	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	28.9	4.28	
422	10EK-4270	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	0.00	0.50	
423	10EK-4271	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	34.1	5.38	
424	10EK-4272	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	29.2	0.50	

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TABLE I-4
TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
425	10EK-4273	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	24.0	0.50	
426	10EK-4301	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	0.00	0.00	
427	10EK-4302	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	16.8	16.83	U
428	10EK-4303	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	12.6	3.87	
429	10EK-4304	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	25.4	5.29	
430	10EK-4305	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	99.9	7.66	
431	10EK-4306	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	384	13.08	
432	10EK-4307	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	750	17.41	
433	10EK-4308	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	2470	36.27	
434	10EK-4309	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	2920	41.18	
435	10EK-4369	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/28/07	mg/kg	141	8.29	
437	10EK-4371	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/28/07	mg/kg	7.95	0.50	
438	10EK-4469	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/28/07	mg/kg	10.1	0.50	
439	10EK-4471	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/28/07	mg/kg	6.05	0.50	
475	10EK-6101	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	21.2	0.5	
476	10EK-6102	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.28	0.5	
477	10EK-6103	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	12.9	0.5	
478	10EK-6104	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	7.66	0.5	
479	10EK-6105	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	12.0	0.5	
480	10EK-6106	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	3.36	0.5	
481	10EK-6107	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	1.90	0.5	
482	10EK-6108	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	6.13	0.5	
483	10EK-6109	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	3.07	0.5	
484	10EK-6110	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.99	0.5	
485	10EK-6111	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.40	0.5	
486	10EK-6112	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.91	0.5	
487	10EK-6113	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.46	0.5	
488	10EK-6114	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	1.71	0.5	
489	10EK-6115	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	5.25	0.5	
490	10EK-6116	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	1.24	0.5	U
491	10EK-6117	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	11.1	0.5	

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TABLE I-4
TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
492	10EK-6118	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	27.5	0.5	
493	10EK-6119	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.21	0.5	
494	10EK-6120	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	0.82	0.5	U
495	10EK-6121	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	9.53	0.5	
496	10EK-6122	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	11.4	0.5	
497	10EK-6123	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	0.60	0.5	U
498	10EK-6124	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	10.7	0.5	
499	10EK-6125	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.59	0.5	
500	10EK-6126	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	9.72	0.5	
501	10EK-6127	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	25.7	0.5	
502	10EK-6128	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	1.75	0.5	
503	10EK-6129	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	3.21	0.5	
504	10EK-6130	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	87.2	0.5	J
505	10EK-6131	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	29.7	0.5	
506	10EK-6132	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	28.7	0.5	
507	10EK-6133	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	14.2	0.5	
508	10EK-6134	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	10.6	0.5	
509	10EK-6135	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	267	0.5	J
510	10EK-6136	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	204	0.5	J
511	10EK-6137	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	85.4	0.5	J
512	10EK-6138	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	125	0.5	J
513	10EK-6139	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	85.8	0.5	J
514	10EK-6140	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	35.9	0.5	
515	10EK-6141	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	9.40	0.5	
516	10EK-6142	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	14.7	0.5	
517	10EK-6143	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	334	11.4	
518	10EK-6144	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	55.3	0.5	
519	10EK-6145	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	29.0	0.5	
520	10EK-6146	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	142	0.5	J
521	10EK-6147	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	22.9	0.5	
522	10EK-6148	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	63.9	0.5	

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TABLE I-4
TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
523	10EK-6149	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	34.7	0.5	
524	10EK-6150	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	31.5	0.5	
525	10EK-6151	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	63.4	0.5	
526	10EK-6152	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	40.8	0.5	
527	10EK-6153	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	33.3	0.5	
528	10EK-6154	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	18.0	0.5	
529	10EK-6155	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	11.5	0.5	
530	10EK-6156	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	34.7	0.5	
531	10EK-6157	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	16.0	0.5	
532	10EK-6158	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	4.85	0.5	
533	10EK-6159	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	4.92	0.5	
534	10EK-6160	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	61.1	0.5	
535	10EK-6161	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	99.4	0.5	J
536	10EK-6162	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	49.4	0.5	
537	10EK-6163	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	58.5	0.5	
538	10EK-6164	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	47.2	0.5	
539	10EK-6165	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	79.5	0.5	
540	10EK-6166	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	212	10.0	
541	10EK-6167	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	266	10.6	
542	10EK-6168	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	59.2	0.5	
543	10EK-6169	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	43.3	0.5	J
544	10EK-6170	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	43.4	0.5	
545	10EK-6171	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	26.2	0.5	
546	10EK-6172	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	31.6	0.5	
547	10EK-6269	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	32.6	0.5	
548	10EK-6270	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	31.4	0.5	
549	10EK-6271	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	18.6	0.5	
550	10EK-6272	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	10.2	0.5	
551	10EK-6273	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	16.9	0.5	

TABLE I-5
TOTAL MERCURY IN SEDIMENT FROM DENNIS CREEK
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	Lumex Result	Lumex Reporting Limit	Qualifier
565	10EK-8001	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.14	0.5	
566	10EK-8002	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.68	0.5	
567	10EK-8003	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.32	0.5	
568	10EK-8004	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.49	0.5	
569	10EK-8005	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.00	0.5	
570	10EK-8006	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	17.9	0.5	
571	10EK-8007	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.81	0.5	
572	10EK-8008	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.30	0.5	
573	10EK-8009	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	2.91	0.5	
574	10EK-8010	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.55	0.5	
575	10EK-8011	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	4.93	0.5	
576	10EK-8012	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.22	0.5	
577	10EK-8013	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.05	0.5	
578	10EK-8014	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.57	0.5	
579	10EK-8015	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	6.17	0.5	
580	10EK-8016	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.34	0.5	
581	10EK-8017	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.11	0.5	
582	10EK-8018	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	6.07	0.5	
583	10EK-8019	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.67	0.5	
584	10EK-8020	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	5.73	0.5	
585	10EK-8021	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.99	0.5	
586	10EK-8022	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.05	0.5	
587	10EK-8023	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	3.28	0.5	
588	10EK-8024	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.20	0.5	
589	10EK-8025	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.86	0.5	
590	10EK-8026	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.83	0.5	
591	10EK-8027	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.63	0.5	
592	10EK-8028	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.50	0.5	
593	10EK-8029	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.91	0.5	
594	10EK-8030	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.07	0.5	
615	10EK-8031	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.6	0.5	
596	10EK-8032	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.79	0.5	

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TABLE I-5
TOTAL MERCURY IN SEDIMENT FROM DENNIS CREEK
BLACK BUTTE MINE
LANE COUNTY, OREGON

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	Lumex Result	Lumex Reporting Limit	Qualifier
597	10EK-8033	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.46	0.5	U
598	10EK-8034	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	17.4	0.5	
599	10EK-8035	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	3.03	0.5	
600	10EK-8036	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	2.50	0.5	
601	10EK-8037	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.09	0.5	
602	10EK-8038	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.27	0.5	
603	10EK-8039	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.77	0.5	
604	10EK-8040	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.78	0.5	
605	10EK-8041	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	7.17	0.5	

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II. EFFECTIVENESS OF REMOVAL ACTIONS

A. ACTIONS TAKEN BY PRPS

Since 1994, the site has been owned by the Land and Timber Company and who is considered a PRP. No other viable potentially responsible party (PRP) has been identified.

B. ACTIONS TAKEN BY STATE AND LOCAL FORCES

Since the early 1990s, ODEQ, in conjunction with Oregon State University and others, has conducted on-going investigations of the Black Butte Mine and surrounding areas. During the Removal Action, ODEQ continued involvement at the site and provided support to EPA.

ODEQ agreed to conduct post-removal sampling to verify the removal effectiveness and determine if any additional cleanup work is required and also agree to conduct annual inspections of the Main Tailings Pile slope, repository, and capped areas.

The State Archaeologist, with the State Historic Preservation Office (SHPO), was sent information about the planned removal work. Based on the feedback from the SHPO, a Cultural Resource Survey was initiated. Archaeological Investigations Northwest, Inc. (AINW) was contracted through E & E to conduct an archaeological survey of the project Area of Potential Effects to address the project's possible impacts on significant archaeological resources. As the project is a federal undertaking, AINW's work was done in compliance with Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations (36 C.F.R. § 800), and according to the requirements of the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation.

Records from the Oregon SHPO were reviewed to determine if archaeological sites had been recorded or if archaeological surveys had been conducted in the vicinity of the Black Butte Mine. A review of the National Register of Historic Places was also conducted to determine if any listed archaeological or historic properties are located in or near the proposed project area. The results indicated that no listed archaeological sites were in or near the proposed project area. A review of the SHPO database, which is a listing of the Oregon Inventory of Historic Properties, indicated no inventoried resources were located in the proposed project area.

C. ACTIONS TAKEN BY FEDERAL AGENCIES AND SPECIAL TEAMS

Patricia McGrath of the EPA Region 10 Mining Team was briefed on the pending removal and agreed with the need for a clean-up at the BBM and the proposed removal actions. The BBM is the only mercury mine with drainage to the Cottage Grove Reservoir.

At the request of the OSC, the USCG participated in the RA to perform Health and Safety oversight and dust monitoring and assist with onsite mercury analysyes. Two USCG members were on-site for the RA.

D. ACTIONS TAKEN BY CONTRACTORS, PRIVATE GROUPS, AND VOLUNTEERS

The Removal Action was performed by ERRS under the direction of the OSC. START assisted with field sampling and on-site analysis.

1. Removal Activities

The BBM Removal Action was performed from August 20 through September 3, 2007. Removal Action activities began with the mobilization of the personnel, equipment, and supplies to be used for the Removal Action. Earth-moving equipment used by ERRS for the RA and Office trailers were mobilized to the site. Several bridges on the county road accessing the site had weight restrictions that made it necessary for ERRS to get permission for the heavier equipment to use a private road to the site. The heaviest equipment was unloaded and driven across the final bridge at the entrance to the site to avoid damaging the bridge.

Once site personnel arrived on site, a general site Health and Safety meeting was held to discuss the planned cleanup activities and related issues. Topics included a discussion of the health risks for the contaminants of concern (mercury) and other safety topics, such as working around heavy equipment and heat stress. In addition to the initial general meeting, the site workers participated in daily Health and Safety meetings at the start of each work day.

The following subsections describe the Removal Activities undertaken at the BBM site.

a) Main Tailings Pile

Where waste rock and tailings along the northeast side of the Main Tailings Pile followed a steep angle down toward Dennis Creek, the angle of the slope was decreased to reduce the likelihood that tailings would continue to erode into Dennis Creek. Drainage benches, topsoil, slash and straw bales were installed to minimize erosion and control the flow of water and sediment off the slopes and into Dennis Creek. This process involved the removal of a

substantial volume of tailings from the slope. These tailings were analyzed using an XRF to determine if the mercury concentration was less than the 115 mg/kg action level for dermal contact and suitable for use as cover in other areas of the site. The material that was not used as cover was placed on-site in an area designated as the repository.

b) Old Ore Furnace Area and New Furnace Area

ERRS used tailings removed from the Main Tailings Pile to cover areas around the Old Ore Furnace and the New Furnace that exceeded the 115 mg/kg cleanup criteria for dermal exposure. Confirmation sampling and analysis completed once the cap was in place confirmed that the capping material used was lower than the 115 mg/kg action level.

c) Furnace Creek

Extensive sampling and analysis of the tailings and sediment in Furnace Creek was performed during the Removal Action using both an XRF and a Lumex. Sample locations started upstream from the Old Furnace Area and extended to Garoutte Creek. Results of the sampling and analyses of sediment and bank samples from Furnace Creek indicated that the area adjacent to the Old Furnace and extending down to the confluence with Garoutte Creek consistently exceeded 10 mg/kg mercury. In some areas, total mercury concentrations were at least an order of magnitude above the action level. Furnace creek was heavily vegetated and the bank areas immediately adjacent to the creek were very stable for nearly the entire extent of Furnace Creek below the Old Furnace. The extent of contamination along Furnace Creek was not anticipated prior to the Removal Action, despite the work performed during the removal assessment. Based on the anticipated cost and duration of a clean-up necessary to excavate mercury-contaminated tailings and soils along Furnace Creek and the high potential for environmental damage, this area was not addressed by the Removal Action.

2. Dust Monitoring

Dust monitoring was performed by the USCG using DataRAM 4000 airborne particulate monitors with data loggers. The air monitoring program was designed and implemented for site H&S as well as to ensure that no unnecessary off-site migration of dust occurred. Dust monitoring was performed daily while site activities continued. On days that dust monitoring was performed, the USCG set out a DataRAM instruments near and downwind of daily site activities.

The dust action limit established for the site was 10 micrograms per cubic meter (mg/m^3) of air. Throughout the RA, average dust levels were generally at about 0.1 mg/m^3 or less. Occasionally, brief periods of higher dust concentrations (e.g., "spikes") were observed,

although most dust readings were less than 1.0 mg/m^3. Only three instantaneous readings over 1.0 mg/m^3 were observed, with the highest being 2.9 mg/m^3. Dust levels never exceeded the site action limit of 10 mg/m^3.

Raw data collected by the data loggers of the dust monitoring instruments are maintained in EPA's site file.

III. DIFFICULTIES ENCOUNTERED

A. ITEMS THAT AFFECTED THE RESPONSE

With the exception of Furnace Creek, the Removal Activities were performed as intended and finished on schedule. Although there were no major issues that significantly affected the Removal Action, there were some minor issues that were overcome to complete the RA.

Equipment. ERRS had trouble with some of the rental equipment, including the dozer and the excavator. These pieces of equipment frequently did not work properly when received and required either maintenance or replacement, which caused some delays. After several days the equipment rental subcontractor had replaced most of these items and ERRS continued to work without further delay.

Dust Monitoring Equipment. Occasionally throughout the RA, the DataRAM 4000 dust monitors were not operated properly and the data was not captured.

B. ISSUES OF INTERGOVERNMENTAL COORDINATION

There were no issues that arose while EPA was working with state and local governmental agencies for this RA. ODEQ was well prepared to help with the RA, exceptionally cooperative and assisted with the initial on-site analyses to delineate the areas to be capped. ODEQ also performed the study to determine the local background concentration for mercury and participated in the consensus decisions on the actions levels chosen.

C. DIFFICULTIES INTERPRETING, COMPLYING WITH, OR IMPLEMENTING POLICIES AND REGULATIONS

None

IV. RECOMMENDATIONS

A. MEANS TO PREVENT A RECURRENCE OF THE DISCHARGE OR RELEASE

Contamination was present from the historic mining operations. Mine operations began in the late 1890s and the mine was operated intermittently through the late 1960s. It is believed that much of the soil contamination occurred before the development of environmental regulations and industry practices to prevent such contamination. EPA is not aware of a specific incident or management practices that caused the release so no specific recommendation to prevent a recurrence can be made at this time.

B. MEANS TO IMPROVE RESPONSE ACTIONS

The Removal Action was effective and efficient for the work that could be performed within the EPA Region 10 Removal Program's budget. One recommendation for future Removal Actions is that the removal assessment thoroughly identify the breadth of the contamination, both laterally and in depth, prior to establishing a removal action budget.

C. PROPOSALS FOR CHANGES IN REGULATIONS AND RESPONSE PLANS

None

V. REFERENCES

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Appendix A

Photographic Documentation

BLACK BUTTE MINE
Cottage Grove, Oregon

Main Tailings Pile - West Slope

TDD Number: 06-04-0013
Photographed by: Bryan Ciecko (BC), Kathy Parker (KP)

Photo 1 XRF testing of mercury in tailings removed from Main Tailings Pile - West slope.

Direction: West *Date: 8/22/2007* *Time:* *By: KP*

Photo 2 Moving tailings from Main Tailings Pile - West slope up slope.

Direction: West *Date: 8/22/2007* *Time:* *By: KP*

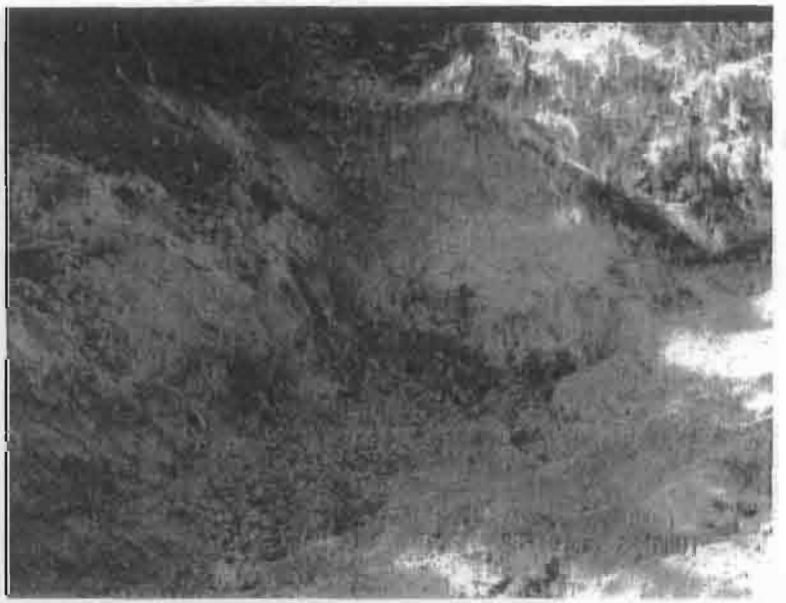

Photo 3 Native soil under tailings on Main Tailings Pile - West slope.

Direction: West *Date: 8/23/2007* *Time:* *By: KP*

Photo 4 Main Tailings Pile - West slope excavator making water bars at

Direction: North *Date: 8/11/2007* *Time: 9:22* *By: BC*

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Photo 5 Main Tailing Pile - West slope with soil cap.

Direction: North Date: 9/3/2007 Time: 16:26 By: BC

Photo 7 Straw bales placed on Main Tailings Pile - West slope.

Direction: Northwest Date: 9/3/2007 Time: By: KP

Photo 6 Main Tailing Pile - West slope showing soil cap and water bar.

Direction: North Date: 9/3/2007 Time: 16:26 By: BC

BLACK BUTTE MINE
Cottage Grove, Oregon

Main Tailings Pile - West Slope

TDD Number: 06-04-0013
Photographed by: Bryan Ciecko (BC), Kathy Parker (KP)

Photo 8 Straw bales placed on Main Tailings Pile - West slope.

Direction: East *Date: 9/3/2007* *Time:* *By: KP*

Photo 9 Clean soil placed on top of Main Tailings Pile - West slope.

Direction: West *Date: 9/3/2007* *Time:* *By: KP*

Photo 10 Dataram monitoring air at top of Main Tailings Pile - West slope.

Direction: Northwest *Date: 9/3/2007* *Time:* *By: KP*

Photo 11 Main Tailing Pile - West slope showing soil cap with woody debris on surface.

Direction: North *Date: 9/4/2007* *Time: 9:58* *By: BC*

Photo 12 Main Tailing Pile - West slope showing soil cap with woody debris on surface .

Direction: North *Date: 9/4/2007* *Time: 10:01* *By: BC*

Photo 13 Main Tailings Pile - West slope showing woody debris placed on surface.

Direction: West *Date: 9/4/2007* *Time:* *By: KP*

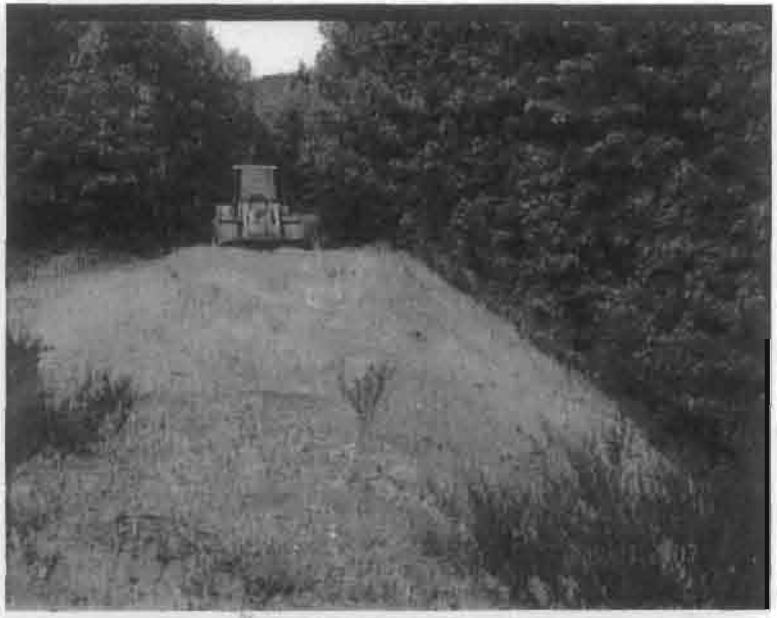

Photo 14 Starting to clear Main Tailings Pile - West slope.

Direction: West *Date: 8/21/2007* *Time:* *By: KP*

Photo 15 Main Tailings Pile - Starting to clear East slope.

Direction: East *Date: 8/21/2007* *Time:* *By: KP*

Photo 16 Moving tailings from Main Tailings Piles to New Furnace Area for capping.

Direction: North *Date: 8/22/2007* *Time:* *By: KP*

Photo 17 Main Tailing Pile - East slope tailings removal.

Direction: East *Date: 8/22/2007* *Time:* *By: KP*

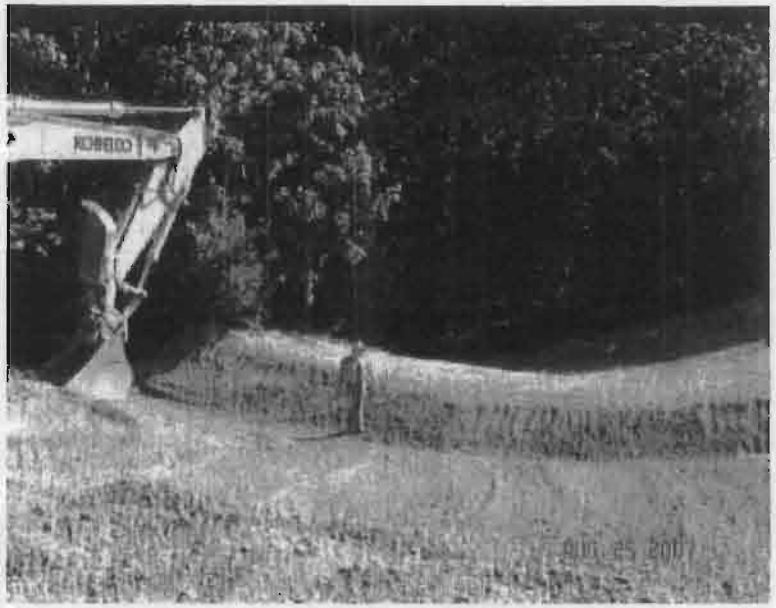

Photo 18 Cutting water bars on Main Tailings Pile - East Slope.

Direction: North *Date: 8/24/2007* *Time:* *By: KP*

Photo 19 Keying tailings into top of Main Tailings Pile - East slope.

Direction: Northeast *Date: 8/25/2007* *Time:* *By: KP*

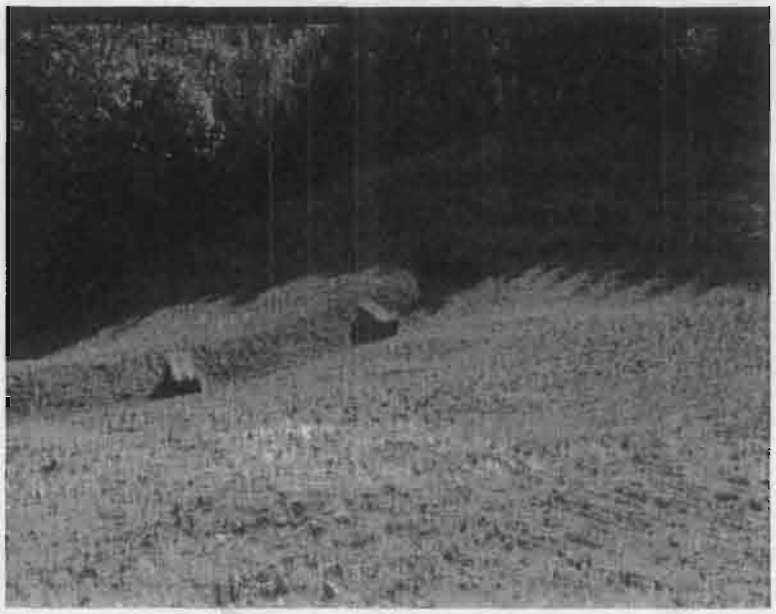

Photo 20 Main Tailings Pile - East slope prior to topsoil and hydroseed.

Direction: East *Date: 8/31/2007* *Time: 9:24* *By: BC*

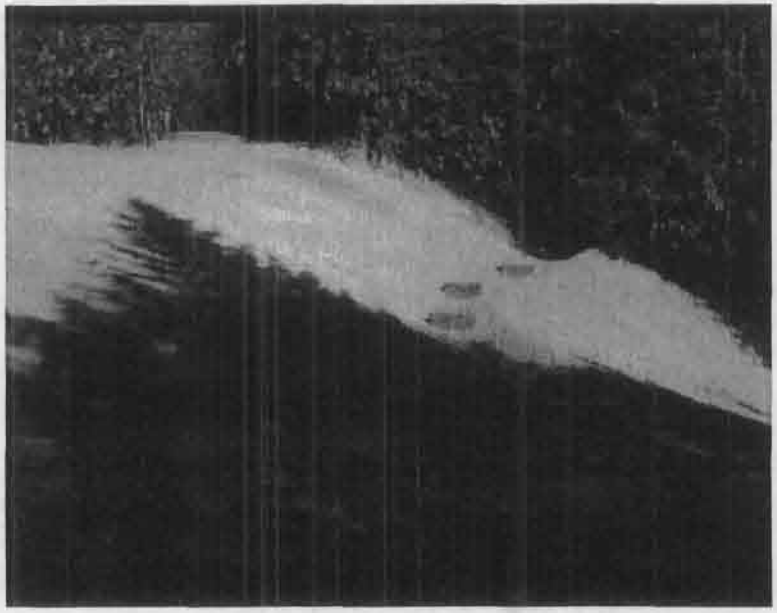

Photo 21 Main Tailings Pile - East slope prior to topsoil and hydroseed.

Direction: Northwest *Date: 8/31/2007* *Time: 9:24* *By: BC*

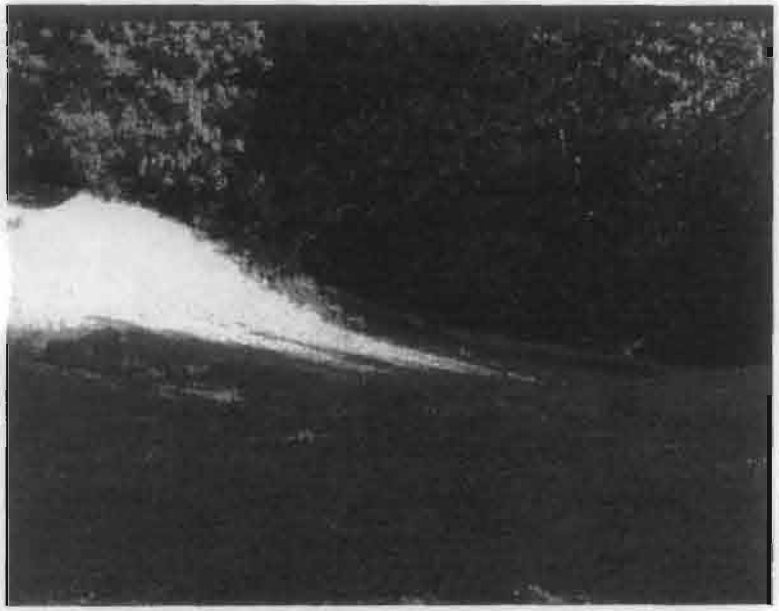

Photo 22 Main Tailings Pile - East slope note straw bales at base.

Direction: Northeast Date: 8/31/2007 Time: 9:24 By: BC

Photo 23 Main Tailings Pile - East slope adding soil cap.

Direction: East Date: 9/3/2007 Time: 16:27 By: BC

Photo 24 Clean cover soil placed on Main Tailings Pile - East slope.

Direction: East Date: 9/3/2007 Time: By: KP

Photo 25 Straw bales at base of Main Tailings Pile - East slope.

Direction: Northeast Date: 9/3/2007 Time: By: KP

Photo 26 Clean soil placed on top of Main Tailings Pile - East slope.

Direction: Northeast *Date: 9/3/2007* *Time:* *By: KP*

Photo 27 Woody debris placed on final slope of Main Tailings Pile - East slope.

Direction: East *Date: 9/5/2007* *Time:* *By: KP*

Photo 28 Opening buried tank in Old Ore Furnace Area.

Direction: Southeast Date: 8/25/2007 Time: By: KP

Photo 29 Starting to cap Old Ore Furnace Area.

Direction: Southeast Date: 8/25/2007 Time: By: KP

Photo 30 Object found and relocated off Old Furnace Area.

Direction: North Date: 8/27/2007 Time: By: KP

Photo 31 High visibility flagging around residential water line.

Direction: South Date: 8/27/2007 Time: By: KP